CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(Autonomous)

Kokapet (Village), Gandipet, Hyderabad, Telangana – 500075

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1.1.3 Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the institution during the last five years

1.1.3.1 Number of courses having focus on employability/ entrepreneurship/ skill development year-wise during the last five years.

Year	2021-22	2020-21	2019-20	2018-19	2017-18
Number	1166	1106	985	922	984

List of courses courses having focus on employability/ entrepreneurship/ skill development offered by the institution during 2020 - 21 from S. No. 1565 – 2277

S.No	Course Name	Code
1565	Linear Algebra & Calculus	20MT C01
1566	English	20EG C01
1567	Optics and Semiconductor Physics	20PY C01
1568	Programming for Problem Solving	20CS C01
1569	Linear Algebra & Calculus Lab	20MT C02
1570	English lab	20EG C02
1571	Optics and Semiconductor Physics Lab	20PY C03
1572	Programming for problem Solving Lab	20CS C02
1573	CAD AND DRAFTING	20ME C01
1574	Community Engagement	20MB C02
1575	Differential Equations & Transform Theory	20MT C03
1576	Chemistry	20CYC01
1577	Industry 4.0	20CS C05
1578	Object Oriented Programming	20CS C03
1579	Differential Equations &Transform Theory Lab	20MT C04
1580	Chemistry Lab	20CYC02
1581	Object Oriented Programming Lab	20CSC04
1582	Workshop / Manufacturing Practice	20ME C02
1583	Engineering Exploration	20ME C03
1584	Basic Electrical Engineering	18EEC01
1585	Data Structures	18CSC07
1586	Discrete Mathematics	18CSC08
1587	Digital Electronics and Logic Design	18CSC09
1588	Principles of Management	18MEC09
1589	Environmental Science	18CEM01
1590	Basic Electrical Engineering Lab	18EEC02
1591	Data Structures Lab	18CSC10
1592	Digital Electronics and Logic Design Lab	18CSC11
1593	Soft Skills	18EGC03
1594	Basic Electronics	18ECC34
1595	Probability and Statistics	18MTC09
1596	Computer Architecture and MicroProcessor	18CSC12

1597	Database Management Systems	18CSC13
1598	Indian Constitution and Fundamental Principles	18EGM01
1599	Basic Electronics Lab	18ECC35
1600	Computer Architecture and MicroProcessor Lab	18CSC14
1601	DBMS Lab	18CSC15
1602	IT Workshop (Latex/Scilab)	18CSC16
1603	Formal Language and Automata Theory	18CSC17
1604	Operating System	18CSC18
1605	Design and Analysis of Algorithms	18CSC19
1606	Web and Internet Technologies	18CSE01
1607	Mobile Application Development	18CSE04
1608	Graph Theory	18MTO 02
1609	Number Theory and Cryptography	18MTO 03
1610	Decision Theory	18MTO 05
1611	Operating System Lab	18CSC20
1612	Design and Analysis of Algorithms Lab	18CSC21
1613	Mini Project-II	18CSC22
1614	Web and Internet Technologies Lab	18CSE05
1615	Mobile Application Development Lab	18CSE08
1616	Data communication and computer networks	18CSC23
1617	Software Engineering	18CSC24
1618	Artificial Intelligence	18CSC25
1619	Engineering economics and accountancy	18MBC01
1620	Indian Traditional Knowledge	18EEM01
1621	Internet of Things	18CSE09
1622	Cloud Computing	18CSE11
1623	Soft Computing	18CSE13
1624	Network and System Administration	18CSE14
1625	Free and Open Source Software	18CSE16
1626	DCCN Lab	18CSC26
1627	Case Study(AI/SE and PE-II Lab)	18CSC27
1628	Data Science and Big Data Analytics	16CSC33
1629	Free and Open Source Software	16CSC34
1630	Distributed and Cloud Computing	16CSC35
1631	Machine Learning	16CSC36
1632	Deep Learning	16CSE10
1633	System and Network Administration	16CSE13
1634	Disaster Mitigation and Management	16CEO 02
1635	Entrepreneurship	16MEO 01
1636	Research Methodologies	16MEO 06
1637	Gender Sensitization	16EGO 02
1638	DSBDA Lab	16CSC37
1639	Machine Learning Lab	16CSC38
1640	Project Seminar	16CSC39
1641	Cyber Security	16CSE 14
1642	Natural Language Processing	16CSE 16
1643	Human Computer Interaction	16CSE 19
1644	Social Networking and its impact	16CSE 20
1645	Blockchain Technology	16CSE 21

1646	Quantum Computing	16MTO04
1647	Intellectual Property Rights	16MEO04
1648	History of Science and Technology	16PYO01
1649	Seminar	16CSC40
1650	Projects	16CSC41
1651	Programming for Problem Solving	20CS C01
1652	Programming for problem Solving Lab	20CS C02
1653	Industry 4.0	20CS C05
1654	Object Oriented Programming	20CS C03
1655	Object Oriented Programming Lab	20CSC04
1656	Basics of Electrical Engineering	20EEC01
1657	Basic Electronics	20ECC35
1658	Data Structures	20CSC08
1659	Discrete Mathematics	20CSC09
1660	Digital Logic Design	20CSC10
1661	Fundamentals of Data Science	20CAC01
1662	Basics of Electrical Engineering Lab	20EEC02
1663	Basic Electronics Lab	20ECC36
1664	Data Structures Lab	20CSC11
1665	Fundamentals of Data Science Lab	20CAC02
1666	Mathematical Foundation for Data Science & Security	20MTC13
1667	Computer Architecture and Microprocessor	20CSC13
1668	Data Base Management Systems	20CSC14
1669	Internet & Web Technologies	20CSC15
1670	Artificial Intelligence	20CAC03
1671	Engineering Economics & Accountancy	20MBC01
1672	Mathematical Foundation for Data Science & Security Lab	20MTC14
1673	Data Base Management Systems Lab	20CSC17
1674	Internet & Web Technologies Lab	20CSC18
1675	Linear Algebra & Calculus	20MT C01
1676	English	20EG C01
1677	Optics and Semiconductor Physics	20PY C01
1678	Programming for Problem Solving	20CS C01
1679	Linear Algebra & Calculus Lab	20MT C02
1680	English lab	20EG C02
1681	Optics and Semiconductor Physics Lab	20PY C03
1682	Programming for problem Solving Lab	20CS C02
1683	CAD AND DRAFTING	20ME C01
1684	Community Engagement	20MB C02
1685	Differential Equations & Transform Theory	20MT C03
1686	Chemistry	20CYC01
1687	Industry 4.0	20CS C05
1688	Object Oriented Programming	20CS C03
1689	Differential Equations &Transform Theory Lab	20MT C04
1690	Chemistry Lab	20CYC02
1691	Object Oriented Programming Lab	20CSC04
1692	Workshop / Manufacturing Practice	20ME C02
1693	Engineering Exploration	20ME C03
1694	Mathematical Foundation of Computer Science	20CSC 101

1695	Advanced Data Structures	20CSC 102
1696	Research Methodology and IPR	20MEC 103
1697	Machine Learning	20CSE101
1698	Data Science & Big Data Analytics	20CSE113
1699	ENGLISH FOR RESEARCH PAPER WRITING	20EGA101
1700	Laboratory 1 (Advanced Data Structures)	20CSC 103
1701	Machine Learning Lab	20CSE107
1702	Advanced Algorithms	20CSC 104
1703	Soft Computing	20CSC105
1704	Disaster mitigation and management	20CEA101
1705	Value Education	20ECA101
1706	Data Preparation and Analysis	20CSE104
1707	Human and Computer Interaction	20CSE116
1708	Laboratory 3(AA& Soft Computing)	20CSC 106
1709	Data Preparation and Analysis Lab	20CSE110
1710	Mini Projects with seminar	20CSC 107
1711	Open Source Technologies	19CSE121
1712	Business Analytics	19CSO101
1713	Dissertation Phase – I	19CSC 108
1714	Dissertation Phase – II	19CSC 109
1715	Linear Algebra & Calculus	20MT C01
1716	English	20EG C01
1717	Optics and Semiconductor Physics	20PY C01
1718	Programming for Problem Solving	20CS C01
1719	Linear Algebra & Calculus Lab	20MT C02
1720	English lab	20EG C02
1721	Optics and Semiconductor Physics Lab	20PY C03
1722	Programming for problem Solving Lab	20CS C02
1723	CAD and Drafting	20ME C01
1724	Community Engagement	20MB C02
1725	Differential Equations & Transform Theory	20MT C01
1726	Chemistry	20EG C01
1727	Data Structures and Algorithms	20PY C01
1728	Object Oriented Programming using Python	20CS C01
1729	Differential Equations & Transform Theory Lab	20MT C02
1730	Chemistry Lab	20EG C02
1731	Data Structures and Algorithms Lab	20PY C03
1732	Object Oriented Programming using Python Lab	20CS C02
1733	Workshop / Manufacturing Practice	20ME C01
1734	Engineering Exploration	20MB C02
1735	Data Structures and Algorithms	18ITC04
1736	Discrete Mathematics and Applications	18IT C05
1737	Basic Electronics	18EC C34
1738	Principles of Management	18ME C09
1739	Basic Electrical Engineering	18EE C01
1740	Environmental Science	18CE M01
1741	Data Structures and Algorithms Lab	18IT C06
1742	Mini Project – I	18IT C08
1743	Basic Electronics Lab	18EC C35

1744	Soft Skills	18EG C03
1745	Basic Electrical Engineering Lab	18EE C02
1746	Digital Logic and Computer Architecture	18IT C03
1747	Database Management Systems	18IT C09
1748	Java Programming	18IT C10
1749	Design and Analysis of Algorithms	18IT C11
1750	Probability and Statistics	18MT C09
1751	Indian Constitution	18EG M01
1752	IT Workshop	18IT C07
1753	Database Management Systems Lab	18IT C12
1754	Java Programming Lab	18IT C13
1755	Mini Project - II	18IT C14
1756	Operating Systems	18IT C15
1757	Theory of Automata	18IT C16
1758	Computer Networks	18IT C17
1759	Software Engineering	18IT C18
1760	Data Warehousing and Data Mining	18IT E01
1761	UNIX and Shell Programming	18IT E04
1762	Predictive Analytics with ‗R'	18IT E05
1763	Operating Systems and Computer Networks Lab	18IT C19
1764	Software Engineering Lab	18IT C20
1765	Mini Project - III	18IT C21
1766	Artificial Intelligence	18IT C22
1767	Information Security	18IT C23
1768	Social Media Analytics	18IT E09
1769	Mobile Commerce	18IT E12
1770	Data Science with Python	18IT E13
1771	Cyber Security	18IT E16
1772	Engineering Economics and Accountancy	18MB C01
1773	Gender Sensitization	18EG O02
1774	Indian Traditional Knowledge	18EE M01
1775	Artificial Intelligence Lab	18IT C24
1776	Information Security Lab	18IT C25
1777	Mini Project - IV	18IT C26
1778	Embedded Systems & Internet of Things	16IT C31
1779	Distributed Systems	16IT C32
1780	Information Security	16IT C33
1781	Big Data Analytics	16IT C34
1782	Human Computer Interaction	16IT E10
1783	Natural Language Processing	16IT E13
1784	Business Intelligence	16IT E15
1785	Big Data Analytics Lab	16IT C35
1786	Embeeded Systems & Internet of Things Lab	16IT C36
1787	Project Seminar	16IT C37
1788	Social Media Analytics	16IT E17
1789	Research Methodologies	16ME O06
1790	Gender Sensitization	16EG O02
1791	Seminar	16IT C38
1792	Project	16IT C39

1793	Linear Algebra & Calculus	20MT C01
1794	English	20EG C01
1795	Optics and Semiconductor Physics	20PY C01
1796	Programming for Problem Solving	20CS C01
1797	Linear Algebra & Calculus Lab	20MT C02
1798	English lab	20EG C02
1799	Optics and Semiconductor Physics Lab	20PY C03
1800	Programming for problem Solving Lab	20CS C02
1801	CAD and Drafting	20ME C01
1802	Community Engagement	20MB C02
1803	Differential Equations & Transform Theory	20MT C03
1804	Chemistry	20CY C01
1805	Data Structures and Algorithms	20IT C01
1806	Object Oriented Programming using Python	20IT C02
1807	Differential Equations & Transform Theory Lab	20MT C04
1808	Chemistry Lab	20CYC02
1809	Data Structures and Algorithms Lab	20IT C03
1810	Object Oriented Programming using Python Lab	20IT C04
1811	Workshop / Manufacturing Practice	20ME C02
1812	Engineering Exploration	20ME C03
1813	Mathematical Foundations of Data Science	20MTC101
1814	Artificial Intelligence	20ITC101
1815	Social Network Analytics	20ITE105
1816	Digital Image Processing and Analysis	20ITE112
1817	Research Methodology and IPR	20MEM103
1818	English for Research Paper Writing	20EGA101
1819	Mathematical Foundations of Data Science Lab	20MTC102
1820	Artificial Intelligence Lab	20ITC104
1821	Digital Image Processing and Analysis Lab	20ITE122
1822	Introduction to data science	20ITC102
1823	Machine Learning	20ITC103
1824	Information Retrieval System	20ITE103
1825	Deep Learning	20ITE119
1826	Value Education	20ECA101
1827	Introduction to data science Lab	20ITC105
1828	Machine Learning Lab	20ITC106
1829	**Deep Learning Lab**	20ITE129
1830	Mini Project with Seminar	20ITC107
1831	Intrusion Detection (Program Elective-V)	19IT E107
1832	Business Analytics (Open Elective)	19CSO101
1833	Dissertation Phase-I	19IT C107
1834	Project Work and Dissertation	19IT C108
1835	Calculus	20MT C05
1836	Chemistry	20CY C01
1837	Engineering Mechanics-I	20CE C01
1838	Programming for Problem Solving	20CS C01
1839	Chemistry Lab	20CY C02
1840	Programming for Problem Solving Lab	20CS C02
1841	Workshop/ Manufacturing Practice	20ME C02

1842	Engineering Exploration	20ME C03
1843	Vector Calculus and Differential Equations	20MT C06
1844	English	20EG C01
1845	Electromagnetic Theory and Quantum Mechanics	20PY C06
1846	Basic Electrical Engineering	20EE C01
1847	English lab	20EG C02
1848	Electromagnetic Theory and Quantum Mechanics Lab	20PY C09
1849	Basic Electrical Engineering Lab	20EE C02
1850	CAD and Drafting	20ME C01
1851	Community Engagement	20MB C02
1852	Applied mathematics	18MTC07
1853	Analog Electronic Circuits	18EEC03
1854	Electrical Measurements and Instrumentation	18EEC04
1855	Electromagnetic Fields	18EEC05
1856	Electrical Circuit Analysis	18EEC06
1857	Indian constitution	18EGM01
1858	Indian Traditional Knowledge	18EEM01
1859	Analog Electronic Circuits Lab	18EEC07
1860	Electrical Measurements and Instrumentation Lab	18EEC08
1861	Basics of Data Structures	18CSC05
1862	Digital Electronics	18EEC09
1863	Electrical Machines-1	18EEC10
1864	Power Systems-I	18EEC11
1865	Principles of Management	18ME C09
1866	Environmental Science	18CEM01
1867	Basics of Data Structures lab	18CSC06
1868	Digital Electronics Lab	18EEC12
1869	Electrical Machines-1 Lab	18EEC13
1870	Soft Skills Lab	18EGC03
1871	Electrical Machines-II	18EEC14
1872	Power Systems-II	18EEC15
1873	Power Electronics	18EEC16
1874	Engineering Economics and Accountancy	18MBC01
1875	Wind and Solar Energy	18EEE01
1876	Optimization Techniques	18EEE02
1877	Electrical Engineering Materials	18EEE03
1878	Simulation Techniques in Electrical Engineering	18EEE05
1879	Industrial Electrical Systems	18EEE07
1880	Electrical Machines-II Lab	18EEC17
1881	Power Systems-I Lab	18EEC18
1882	Power Electronics Lab	18EEC19
1883	Control Systems	18EEC20
1884	Microprocessors and Microcontrollers	18EEC21
1885	Power Systems Operation and control	18EEC22
1886	Power Quality	18EEE09
1887	Electrical Distribution Systems	18EEE11
1888	HVDC Transmission Systems	18EEE12
1889	AI Techniques In Electrical Engineering	18EEE13
1890	Electric Hybrid Vehicles	18EEE14

1891	Special Electrical Machines	18EEE16
1892	Basics of Cyber Security	18CSO 07
1893	History of Science and Technology	18 PYO 01
1894	Control Systems Lab	18EEC23
1895	Microprocessors Lab	18EEC24
1896	Power System Operation and control	16EE C31
1897	Utilization of Electrical Energy	16EE C32
1898	DSP and Embedded Systems	16EE C33
1899	Power Quality Engineering	16EEE16
1900	Special Electrical Machines	16EEE17
1901	Disaster Mitigation and Management	16CE O02
1902	Machine Learning Using Phyton	16CS O10
1903	Entrepreneurship	16ME O01
1904	Power Systems Simulation Lab	16EE C34
1905	Digital Signal Processor and Embedded Systems Lab`	16EE C35
1906	Project Seminar	16EE C36
1907	Electrical Machine Design	16EE E18
1908	Flexible AC Transmission Systems	16EE E19
1909	Smart Grid	16EE E21
1910	Advanced Power System Protection	16EE E23
1911	Electrical Estimation and Costing	16EE E25
1912	Technical Writing Skills	16EG O01
1913	Industrial Administration and Financial Management	16 ME O08
1914	IOT and Applications	16CS O03
1915	Seminar	16EE C37
1916	Project	16EE C38
1917	Real Time Applications for Power systems	20EEC101
1918	Power Electronic Converters	20EEC102
1919	Artificial Intelligence Techniques	20EEE108
1920	Power Quality	20EEE110
1921	Research Methodology and IPR	20MEC103
1922	English for Research Paper Writing	20EGA101
1923	Power Systems Lab	20EEC103
1924	Power Electronics Simulation Lab	20EEC104
1925	Power System dynamics	20EEC105
1926	Advanced Power Electronic Circuits	20EEC106
1927	Renewable Energy System	20EEE107
1928	Energy Auditing & Management	20EEE113
1929	Disaster Mitigation and Management	20CEA101
1930	Power Electronics Lab	20EEC107
1931	Power Systems Simulation Lab	20EEC108
1932	Mini Project with Seminar	20EEC109
1933	Electric and Hybrid Vehicles	19EEE116
1934	Introduction to Optimization Techniques	19MEO102
1935	Industrial Project/Dissertation Phase I	19EEC110
1936	Dissertation Phase II	19EEC111
1937	Calculus	20MTC05
1938	Chemistry	20CYC01
1939	Engineering Mechanics-I	20CEC01

1940	Programming for Problem Solving	20CSC01
1941	Chemistry Lab	20CYC02
1942	Programming for Problem Solving Lab	20CSC02
1943	Workshop/ Manufacturing Practice	20MEC02
1944	Engineering Exploration	20MEC03
1945	Vector Calculus and Differential Equations	20MTC06
1946	English	20EGC01
1947	Electromagnetic Theory and Quantum Mechanics	20PYC06
1948	Basic Electrical Engineering	20EEC01
1949	English lab	20EGC02
1950	Electromagnetic Theory and Quantum Mechanics Lab	20PYC09
1951	Basic Electrical Engineering Lab	20EEC02
1952	CAD and Drafting	20MEC01
1953	Community Engagement	20MBC02
1954	Applied Mathematics	18MT C07
1955	Basics of Data Structures	18CS C05
1956	Electromagnetic Theory and Transmission Lines	18EC C01
1957	Electronic Devices	18EC C02
1958	Network Theory	18EC C03
1959	Signals and Systems	18EC C04
1960	Environmental Science	18CE M01
1961	Basics of Data Structures Lab	18CSC06
1962	Electronic Devices Lab	18ECC05
1963	Electronic Workshop and Networks Lab	18ECC06
1964	Soft Skills	18EGC03
1965	Analog Circuits	18ECC07
1966	Analog Communication	18ECC08
1967	Antennas and Wave Propagation	18ECC09
1968	Control Systems	18ECC10
1969	Digital Systems Design	18ECC11
1970	Indian Constitution	18EGM01
1971	Indian Traditional Knowledge	18EEM01
1972	Analog Circuits Lab	18ECC12
1973	Analog Communication Lab	18ECC13
1974	Digital Systems Design Lab	18ECC14
1975	Computer Architecture and Microprocessors	18ECC15
1976	Digital Communication	18ECC16
1977	Linear and Digital Integrated Circuits	18ECC17
1978	Principles of Management	18MEC09
1979	Electronic Measurements and Instrumentation	18ECE01
1980	Optical Communication	18ECE03
1981	Telecommunications Switching Systems	18ECE04
1982	Fundamentals of Virtual Reality	18CSO05
1983	Object Oriented Programming Using Java	18ITO01
1984	Quantum Computing	18MTO04
1985	Digital Communication Lab	18ECC18
1986	Linear and Digital Integrated Circuits Lab	18ECC19
1987	Digital Signal Processing	18ECC20
1988	Microcontrollers	18ECC21

1989	Microwave and Radar Engineering	18ECC22
1990	Mobile Cellular Communication	18ECE06
1991	Principles and Applications of AI	18ECE07
1992	CPLD and FPGA Architectures	18ECE11
1993	Data Analytics for signal processing	18ECE12
1994	Satellite Communication	18ECE13
1995	Engineering Economics and Accountancy	18MBC01
1996	Digital Signal Processing Lab	18ECC23
1997	Microcontrollers Lab	18ECC24
1998	Microwave Engineering Lab	18ECC25
1999	Data Communication and Computer Networks	16ECC32
2000	Principles of GNSS	16ECC33
2001	Radar and Satellite Communication	16ECC34
2002	VLSI Design	16ECC35
2003	Principles of Real Time Operating Systems	16ECE09
2004	Speech Processing	16ECE10
2005	Applications of IoT in ECE	16ECE12
2006	Digital Image Processing	16ECE13
2007	Advanced Simulation Lab	16ECC36
2008	ElectronicDesign and Automation Lab	16ECC37
2009	Project Seminar	16ECC38
2010	VLSI Technology	16ECE18
2011	Machine Learning Using Python	16CSO10
2012	Entrepreneurship	16MEO01
2013	Gender Sensitization	16EGO02
2014	Disaster Mitigation and Management	16CEO02
2015	Fundamentals of DBMS	16CSO06
2016	Seminar	16EC C39
2017	Project	16EC C40
2018	Advanced Digital Signal Processing	20EC C102
2019	Wireless and Mobile Communication	20EC C104
2020	Research Methodology and IPR	20ME C103
2021	Global Navigation Satellite Systems	20EC E103
2022	Software Defined and Cognitive Radio	20EC E112
2023	English for Research Paper Writing	20EG A101
2024	Advanced Digital Signal Processing Lab	20EC C106
2025	Wireless and Mobile Communication Lab	20EC C108
2026	Advanced Communication Networks	20EC C101
2027	Antennas and Radiating Systems	20EC C103
2028	Signal Intelligence Systems	20EC E111
2029	Internet of Things	20EC E106
2030	Value Education	20EC A101
2031	Advanced Communication Networks Lab	20EC C105
2032	Antennas and Radiating Systems Lab	20EC C107
2033	Mini Project with Seminar	20EC C109
2034	MIMO Wireless Communications	19EC E108
2035	Cost Management of Engineering Projects	19CE O101
2036	Project work - Project Seminar	19EC C112
2037	Project work - Dissertation	19EC C113

2038	Analog and Digital CMOS VLSI Design	20EC C201
2039	Microcontrollers and Programmable Digital Signal Processors	20EC C203
2040	Research Methodology and IPR	20ME M103
2041	Advanced Computer Organization	20EC E201
2042	VLSI Technology and Physical Design Automation	20EC E213
2043	English for Research Paper Writing	20EG A101
2044	Analog and Digital CMOS VLSI Design Lab	20EC C205
2045	Microcontrollers and Programmable Digital Signal Processors Lab	20EC C206
2046	Embedded System Design using RTOS	20EC C202
2047	VLSI Design Verification and Testing	20EC C204
2048	Low Power VLSI Design	20EC E205
2049	SoC Design	20EC E210
2050	Value Education	20EC A101
2051	RTL Simulation and Synthesis with PLDs Lab	20EC C207
2052	RTOS and VLSI Design Verification Lab	20EC C208
2053	Mini Project with Seminar	20EC C209
2054	FPGA & CPLD Architectures	19EC E204
2055	Cost Management of Engineering Projects	19CE O101
2056	Industrial Project /Dissertation Phase I	19EC C210
2057	Industrial Project /Dissertation Phase II	19EC C211
2058	Management and Organization Behaviour	20MBC101
2059	Managerial Economics	20MBC102
2060	Financial Accounting for Management	20MBC103
2061	Marketing Management	20MBC104
2062	Statistics for Management	20MBC105
2063	Digital Technology	20MBC106
2064	Business Communication Lab	20MBC107
2065	Statistics Lab	20MBC108
2066	Business Environment	20MBO101
2067	Corporate Social Responsibility	20MBO102
2068	Business Law and Ethics	20MBO103
2069	Human Resource Management	20MBC201
2070	Financial Management	20MBC202
2071	Business Research Methods	20MBC203
2072	Operations Research	20MBC204
2073	Operations Management	20MBC205
2074	Business Analytics	20MBC206
2075	Logistics and Supply Chain Management	20MBC207
2076	Personality Development and Career Guidance	20MBSD201
2077	E-Business	20MBO201
2078	Banking Management	20MBO202
2079	Customer Relationship Management	20MBO203
2080	Strategic Management	19MBC117
2081	Investment Management	19MBE101
2082	Financial Markets and Services	19MBE102
2083	Performance and Compensation Management	19MBE103
2084	Training and Development	19MBE104
2085	Product and Brand Management	19MBE105
2086	Business Data Mining	19MBE107

2087	R-Programming	19MBE108
2088	Entrepreneurship Development	19MBC119
2089	Financial Risk Management	19MBE111
2090	Project Appraisal and Financing	19MBE112
2091	International HRM	19MBE114
2092	Services and Retail Marketing	19MB116
2093	Machine Learning and Artificial Intelligence	19MB117
2094	Cloud Computing	19MBE118
2095	E-Commerce Logistics	19MB119
2096	International Logistics	19MBE120
2097	Calculus	20MTC05
2098	Chemistry	20CYC01
2099	Engineering Mechanics-I	20CE C01
2100	Programming for Problem Solving	20CS C01
2101	Chemistry Lab	20CYC02
2102	Programming for Problem Solving Lab	20CS C02
2103	Workshop/ Manufacturing Practice	20MEC02
2104	Engineering Exploration	20MEC03
2105	Vector Calculus and Differential Equations	20MT C06
2106	English	20EG C01
2107	Physics	20PY C07
2108	Basic Electrical Engineering	20EEC01
2109	English lab	20EG C02
2110	Physics Lab	20PY C10
2111	Basic Electrical Engineering Lab	20EEC02
2112	CAD and Drafting	20ME C01
2113	Community Engagement	20MB C02
2114	Mathematics -III	18MT C 05
2115	Technology of Surface Coatings and Oils	18CH C 01
2116	Chemical Engineering Thermodynamics - I	18CH C 02
2117	Numerical Methods in Chemical Engineering	18CH C 03
2118	Material and Energy Balance Computations	18CH C 04
2119	Indian constitution	18EG M 01
2120	Indian Traditional Knowledge	18EE M 01
2121	Numerical methods in Chemical Engineering Lab	18CH C 05
2122	Technology of Surface Coatings and Oils Lab	18CH C 06
2123	Basics of Data Structures	18CS C 05
2124	Chemical Engineering Thermodynamics - II	18CH C 07
2125	Fluid Mechanics	18CH C 08
2126	Material Science	18CH C 09
2127	Principles of Management	18ME C 09
2128	Environment science	18CE M 01
2129	Soft skills lab	18EG C 03
2130	Basics of Data structures Lab	18CS C 06
2131	Chemical Reaction Engineering I	18CH C 10
2132	Mass Transfer I	18CH C 11
2133	Heat Transfer	18CH C 12
2134	Particle and Fluid Particle Processing	18CH C 13
2135	Water Conservation and Management	18CH E 01

2136	Renewable Energy	18CH E 02
2137	Experimental and Analytical Techniques	18CH E 03
2138	Polymer Science and Technology	18CH E 04
2139	Green Technology	18CH E 05
2140	Catalysis	18CH E 06
2141	Chemical Engineering Lab IA - MUO	18CH C 14
2142	Chemical Engineering Lab IB - FM and HT	18CH C 15
2143	Chemical Reaction Engineering II	18CH C 16
2144	Mass Transfer II	18CH C 17
2145	Process Control	18CH C 18
2146	Fluidization Engineering	18CH E 07
2147	Petrochemical Technology	18CH E 08
2148	Biochemical Engineering	18CH E 09
2149	Sugar Technology	18CH E 10
2150	Pulp and Paper Technology	18CH E 11
2151	Food Technology	18CH E 12
2152	Waste Management	18EE O 05
2153	Enterpreneurship	18ME O 04
2154	Basics Of Artificial Intelligence	18CS O 09
2155	Nanomaterials and Technology	18ME O 06
2156	Intellectual Property Rights	18ME O 07
2157	Chemical Engineering Lab IIA - CRE	18CH C 19
2158	Chemical Engineering Lab IIB - MTO and TD	18CH C 20
2159	Mass Transfer Operations –II	16CH C 24
2160	Petrochemical Engineering	16CH C 25
2161	Process Equipment Design	16CH C 26
2162	Transport Phenomena	16CH C 27
2163	Polymer Technology	16CH E 11
2164	Pulp and Paper Technology	16CH E 12
2165	Pollution Control in Process Industries	16CH E 13
2166	Disaster Mitigation and Management	16CE O 02
2167	Entrepreneurship	16ME O 01
2168	Intellectual Property Rights	16ME O 04
2169	Technical Writing Skills	16EG O 01
2170	Equipment Design and Drawing Lab	16CH C 28
2171	Mass Transfer Operations Lab	16CH C 29
2172	Seminar	16CH C 30
2173	Plant Design Economics	16CH C 31
2174	Membrane Separation Technology	16CH E 14
2175	Sugar Technology	16CH E 15
2176	Food Technology	16CH E 16
2177	Nano Materials and Technology	16ME O 05
2178	IoT and application	16CS O 03
2179	History of Science and Technology	16PY O 01
2180	Gender Sensitization	16EG O 02
2181	Project Seminar	16CH C 32
2182	Project	16CH C 33
2183	Building Construction Practice	18CE C02
2184	Solid Mechanics	18CE C03

2185	Surveying and Geomatics	18CE C04
2186	Fluid Mechanics	18CE C05
2187	Indian Constitution	18EG M01
2188	Indian Traditional Knowledge	18EE A01
2189	Surveying and Geomatics Lab	18CE C06
2190	Fluid Mechanics Lab	18CE C07
2191	Basic Data Structures	18CS C05
2192	Hydraulic Engineering	18CE C08
2193	Reinforced Concrete Design-I	18CE C09
2194	Structural Analysis-I	18CE C10
2195	Principles of Management	18MEC09
2196	Environmental Science	18CE M01
2197	Basics of Data Structures Lab	18CS C06
2198	Solid Mechanics Lab	18CE C11
2199	Hydraulic Engineering Lab	18CE C12
2200	Soft Skills Lab	18EG C03
2201	Transportation Engineering	18CE C13
2202	Geotechnical Engineering	18CE C14
2203	Structural Analysis-II	18CE C15
2204	Engineering Economics and Accountancy	18MB C01
2205	Transportation Engineering Lab	18CE C16
2206	Geotechnical Engineering Lab	18CE C17
2207	Auto CAD Lab	18CE C18
2208	Prestressed Concrete	18CE E01
2209	Green Building Technologies	18CE E02
2210	Principles of Geographical Information Systems	18CE E03
2211	Masonry Structures	18CE E04
2212	Solid and Hazardous Waste Management	18CE E05
2213	Mechanics of Materials	18CE E06
2214	Repair and Rehabilitation of Structures	18CE E07
2215	Concrete Technology	18CE E08
2216	Design of Steel Structures-I	18CE C 19
2217	Environmental Engineering	18CE C20
2218	Engineering Geology	18CE C21
2219	Environmental Engineering Lab	18CE C22
2220	Engineering Geology lab	18CE C23
2221	Advanced Structural Analysis	18CE E09
2222	Foundation Engineering	18CE E10
2223	Water Shed Management	18CE E11
2224	Urban Transportation Planning	18CE E12
2225	Finite Element Methods	18CE E13
2226	Reinforced Concrete Design-II	18CE E14
2227	Railway Engineering	18CE E15
2228	Ground Water	18CE E16
2229	Fundamentals of DBMS	18CS O06
2230	Entrepreneurship	18ME O04
2231	Technical Writing Skills	18EG O01
2232	Energy Management Systems	18EE O04
2233	Water Resources Engineering-II	16CE C34

2234	Design of Steel structures-I	16CE C35
2235	Estimation and Specifications	16CE C36
2236	Computer Applications Lab	16CE C37
2237	Project Seminar	16CE C38
2238	Advanced Reinforced Concrete Design	16CE E07
2239	Advanced Environmental Engineering	16CE E08
2240	Ground Improvement Techniques	16CE E09
2241	Elements of Earthquake Engineering	16CE E10
2242	Advanced Transportation Engineering	16CE E11
2243	Design and Detailing of Irrigation Structures	16CE E12
2244	Fundamentals of DBMS	16CS O06
2245	Entrepreneurship	16ME O01
2246	Technical Writing Skills	16EG O01
2247	Energy Management Systems	16EE O02
2248	Seminar	16CE C39
2249	Project	16CE C40
2250	Design of Steel structures-II	16CE E13
2251	Advanced steel Design	16CE E14
2252	Industrial Structures	16CE E15
2253	Intellectual Property Rights	16ME O04
2254	Gender Sensitization	16EG O02
2255	Basics of Artificial Intelligence	16CS O09
2256	Waste Management	16EE O05
2257	Health Monitoring and Retrofitting of Structures	16CE E16
2258	Ground Water Hydrology	16CE E17
2259	Pre-stressed Concrete	16CE E18
2260	Structural Dynamics	20CE C101
2261	Finite Element Method in Structural Engineering	20CE C102
2262	Advanced Structural Analysis	20CE E104
2263	Structural Health Monitoring	20CE E104
2264	English for Research Paper Writing	19EG A101
2265	Structural Design Lab	20CE C103
2266	Advanced Structural Concrete Lab	20CE C104
2267	Design of High Rise Structures	20CEC105
2268	Advanced Solid mechanics	20CEC106
2269	Repair and Retrofitting of Structures	20CEC107
2270	Advanced Foundation Design	20CEE110
2271	Disaster Mitigation and Management	20CEA101
2272	Model Testing Lab	20CEC107
2273	Numerical Analysis Lab	20CEC108
2274	Mini Project With Seminar	20CEC109
2275	Design of Prestressed Concrete Structures (DoPCS)	19CE E114
2276	Waste to Energy(WTE)	19EE O103
2277	PROJECT PRESENTATION	19CE C110

SCHEME OF INSTRUCTION AND SYLLABI (R-20)

OF

B.E. I & II SEMESTERS

IN

COMPUTER SCIENCE & ENGINEERING

(For the batch admitted in 2020-21)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

Affiliated to Osmania University

Kokapet Village, Gandipet Mandal, Hyderabad– 500 075. Telangana

E-Mail: principal@cbit.ac.in; Website: www.cbit.ac.in; Phone Nos.: 040-24193276 / 277 / 279

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

INSTITUTE VISION AND MISSION:

Vision: To be a Centre of Excellence in Technical Education and Research

Mission: To address the emerging needs through quality technical education and advanced research

DEPARTMENT VISION AND MISSION:

Vision: To be in the frontiers of Computer Science and Engineering with academic excellence and Research

Mission: The mission of Computer Science and Engineering Department is to:
1. Educate students with the best practices of Computer Science by integrating the latest research into the curriculum
2. Develop professionals with sound knowledge in theory and practice of Computer Science and Engineering
3. Facilitate the development of academia-industry collaboration and societal outreach programs
4. Prepare students for full and ethical participation in a diverse society and encourage lifelong learning

PROGRAM EDUCATION OBJECTIVES (PEOs): After the completion of the program, our:
1. Graduates will apply their knowledge and skills to succeed in their careers and/or obtain advanced degrees, provide solutions as entrepreneurs
2. Graduates will creatively solve problems, communicate effectively, and successfully function in multi-disciplinary teams with superior work ethics and values
3. Graduates will apply principles and practices of Computer Science, mathematics and Science to successfully complete hardware and/or software-related engineering projects to meet customer business objectives and/or productively engage in research

PROGRAM SPECIFIC OUTCOMES (PSOs): At the end of the program
1. Graduates will acquire the practical competency in Computer Science and Engineering through emerging technologies and open-source platforms related to the domains
2. Graduates will design and develop innovative products by applying principles of computer science and engineering
3. Graduates will be able to successfully pursue higher education in reputed institutions and provide solutions as entrepreneurs.
4. Graduates will be able to work in multidisciplinary teams for career growth by exhibiting work ethics and values

ABOUT THE DEPARTMENT:

Department of CSE was established in the year 1985 with an intake of 20 students in UG program, gradually increased to 30 in 1991, 40 in 1993, 60 in 1994, 120 in 2000, 180 in 2013.Currently the department offers three UG programs BE (CSE), BE CSE (AI& ML), BE CSE (Internet of Things & Cyber Security including Block Chain Technology) with an intake of 300. M.Tech. CSE was started in the year 2002 with an intake of 18 and increased to 36 in 2011. The intellectual ambiance in CSE Department is conducive to the holistic development of the students.

BE-CSE program was first accredited by the NBA (AICTE) during 1998 with 'A' grade for 3 years , and further accredited during 2004, 2008, 2013 and 2017 consecutively. CSE department is a recognized Research center under Osmania University. CSE Faculty and students as part of their scholarly activities have published patents. Further both faculty and students have research publications in journals of international and national repute. In addition to the normal duties, faculty and Students continuously involve themselves in research and development activities. AICTE, UGC have funded research projects. Skill and Personality Development Centre and PRERANA centres are established with funds received through AICTE.

Department of CSE has centers of excellence in Internet of Things, Artificial Intelligence/Machine Learning, Cyber Security, Association for Artificial Intelligence in HealthCare. Department is also having MoU's with MSME, Robotic Process Automation, Kernel Sphere Technologies, Telangana State Council of Science and Technology and Data Security Council of India.

Department has committed well qualified and professionally active staff. Most of them are pursuing Ph.D. in the emerging areas like AI, ML, Cyber Security, Data Science, Data Mining and Block Chain .

Department is professionally active in conducting workshops and certifications with Microsoft, IBM, Oracle, SAP, Pega . Various activities are also conducted in collaboration with professional bodies like CSI, ISTE along with student branches of IEEE and CSI.

Department encourages the use of open source software and has vibrant technical clubs: CBIT Open Source (COSC) Club and CBIT Information Security Club (CISC). Through these clubs students have participated in various international and national Hackathons and bagged several prizes. Consecutively for the past three years CSE students have won first prize in Smart India Hackathon (SIH).

Students have participated in large numbers and won many worthy prizes in national and international coding competitions. They also presented papers in conferences and attended seminars, bootcamps and workshops.

CSE has maintained an excellent placement record by providing its students with ample opportunities to pursue their career goals. Leading companies that visited the campus for placements include Microsoft, JP Morgan, Accolite, NCR, Oracle, TCS, Infosys, Deloitte, D.E.Shaw, Sales Force, Service Now, Modak, etc., with CTC going well beyond 24 LPA. The number of students who are doing internship is gradually increasing year by year.

During 2017-18, 204 CSE students secured 287 job offers. In 2018-19, the offers increased to 291 for 214 students, further 311job offers for 224 students during 2019-20. The salary trend in CSE has improved over the years with an average salary being 7.1 LPA. The highest salary offered in Placement 2020 is 41.6 LPA. Microsoft offered the highest CTC of 41.60 LPA. Six students have got their placement in Microsoft with the Super Dream Offer. From the batch of 211 students, 65 students secured multiple job offers out of which 23 students secured three offers.

ABOUT B.E. (CSE) PROGRAM:

In order to understand the needs and problems in the real world, one must have the foundational aspects of computing, science and engineering skills to create, invent, generate, contrive, devise ideas with their ingenium.

B.E Computer Science and Engineering program begins with basic sciences and mathematics, which gives theoretical foundational knowledge for computing .Students acquire knowledge in computing and application domains at different levels of abstraction which includes hardware and software related courses, efficient models, techniques, algorithms for handling data. Students learns modern tools and methodologies which can be applied for the real world problems.

The first half of BE (CSE) program focuses on building the foundations and the second half is for developing the skills and knowledge of the students in various computing and application domains of their choice.

This program is best suited for students seeking to build world-class expertise in Computer Sciences or to undertake advanced studies for research careers or to take up Entrepreneurship.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of I Semester of B.E. – Computer Science & Engineering as per AICTE Model Curriculum 2020-21

B.E. - COMPUTER SCIENCE & ENGINEERING

SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20MT C01	Linear Algebra & Calculus	3	-	-	3	40	60	3
2	20EG C01	English	2	-	-	3	40	60	2
3	20PY C01	Optics and Semiconductor Physics	3	-	-	3	40	60	3
4	20CS C01	Programming for Problem Solving	3	-	-	3	40	60	3
PRACTICAL									
5	20MT C02	Linear Algebra & Calculus Lab	-	-	2	3	50	50	1
6	20EG C02	English lab	-	-	2	3	50	50	1
7	20PY C03	Optics and Semiconductor Physics Lab	-	-	4	3	50	50	2
8	20CS C02	Programming for problem Solving Lab	-	-	4	3	50	50	2
9	20ME C01	CAD AND DRAFTING	-	1	3	3	50	50	2.5
10	20MB C02	Community Engagement	30 field + 2P/W			-	50	-	1.5
TOTAL			**11**	**1**	**15**	**-**	**460**	**490**	**21**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

20MT C01

LINEAR ALGEBRA & CALCULUS
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To explain the solutions of system of linear equations by Matrix Methods.
2. To discuss the convergence and divergence of the Series.
3. To explain the Partial Derivatives and the extreme values of functions of two variables
4. To discuss Physical interpretations on Scalars and vector functions
5. To discuss vector line, surface and volume integrals.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the Matrix Methods to solve the system of linear equations
2. Test the convergence and divergence of the infinite Series.
3. Determine the extreme values of functions of two variables.
4. Apply the vector differential operator to scalar and vector functions
5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.

UNIT-I

Matrices: Rank of a matrix, Echelon form, consistency of linear System of equations, Linear dependence of vectors, Eigen values, Eigenvectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-II

Infinite Series: Definition of Convergence of sequence and series. Series of positive terms –Necessary condition for convergence, Comparison tests, limit form comparison test, D'Alembert's Ratio test, Raabe's test, Cauchy's root test, alternating series, Leibnitz's rule, absolutely and conditionally convergence.

UNIT-III

Partial Differentiation and Its Applications : Functions of two or more variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions, Jacobians, Taylor's expansion of functions of two variables, Maxima and minima of functions of two variables.

UNIT-IV

Vector Differential Calculus: Scalar and vector point functions, vector operator Del, Gradient, Directional derivative, Divergence, Curl, Del applied twice to point functions, Del applied to product of point functions (vector identities). Applications: Irrotational fields and Solenoidal fields.

UNIT-V

Vector Integral Calculus: Line integral, Surface integral and Volume integral. Green's theorem in the plane, verifications of Stroke's theorem (without proof) and Gauss's divergence theorem (without proof).

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition,2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Professor and Head Department

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw- Hill, New Delhi,2 008.
2. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

20 EG C01

ENGLISH

(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Course Objectives: This course will introduce the students:

1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

Course Outcomes: After successful completion of the course the students will be able to:

1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques

UNIT-I Understanding Communication in English:
Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.
Vocabulary &Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT-II Developing Writing Skills I:
Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.
Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT-III Developing Writing Skills II:
Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response
Vocabulary and Grammar: Subject-verb agreement.
Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

UNIT-IV Developing Writing Skills III:
Report writing – Importance, structure, elements of style of formal reports ; Writing a formal report.
Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

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UNIT-V Developing Reading Skills:
The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar: Words often confused; Use of standard abbreviations.

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP. 1995.

Suggested Readings:

1. Wood F.T, Remedial English Grammar,Macmillan,2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, Communication Skills. Oxford University Press, 2011.

Professor and Head Department

with effect from the Academic Year 2020-21

Code: 20PY C01

OPTICS AND SEMICONDUCTOR PHYSICS

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	3 L / week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of the course is to make the student

1. Understand the fundamentals of wave nature of light
2. Acquire knowledge of lasers, holography and fiber optics
3. Familiarize with quantum mechanics
4. Learn the fundamental concepts of solids

Course Outcomes: At the end of the course, the student will be able to

1. Demonstrate the physical properties of light.
2. Explain characteristic properties of lasers and fiber optics
3. Find the applications of quantum mechanics
4. Classify the solids depending upon electrical conductivity
5. Identify different types of semiconductors

UNIT-I

Wave Optics: Huygens' principle –Superposition of waves –Interference of light by wave front splitting and amplitude splitting–Fresnel's biprism – Interference in thin films in reflected light– Newton's rings– Fraunhofer diffraction from a single slit –Double slit diffraction – Rayleigh criterion for limit of resolution– Concept of N-slits–Diffraction grating and its resolving power.

UNIT-II

Lasers & Holography: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion –Different types of lasers: solid-state lasers: Ruby & Nd:YAG; gas lasers: He-Ne & CO_2; semiconductor laser –Applications of lasers in engineering and medicine. Holography: Principle – Recording and reconstruction–Applications.

Fiber Optics: Introduction –Construction –Principle –Propagation of light through an optical fiber – Numerical aperture and acceptance angle –Step-index and graded-index fibers –Pulse dispersion –Fiber losses–Fiber optic communication system –Applications.

UNIT-III

Principles of Quantum Mechanics: Introduction –Wave nature of particles – de-Broglie hypothesis – Physical significance of ψ –Time-dependent and time-independent Schrodinger equations – Born interpretation – Probability current –Wave packets –Uncertainty principle –Particle in infinite square well potential –Scattering from potential step – Potential barrier and tunneling.

UNIT-IV

Band Theory of Solids: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level –Density of states – Bloch's theorem for particles in a periodic potential – Kronig-Penney model – Classification of solids: metals, semiconductors and insulators.

UNIT-V

Semiconductors: Intrinsic and extrinsic semiconductors –Charge carrier concentration in intrinsic semiconductors – Dependence of Fermi level on carrier concentration and temperature in extrinsic semiconductors (qualitative) –Carrier generation and recombination –Carrier transport: diffusion and drift – P-N junction – Thermistor – Hall effect – LED –Solar cell.

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Text Books:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

Suggested Reading:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

20CS C01

PROGRAMMING FOR PROBLEM SOLVING
(Common to all Programs)

Instruction	3 Periods per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of this course are
1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
4. Develop in tuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify and understand the computing environments for scientific and mathematical problems.
2. Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
3. Choose data types and control structures to solve mathematical and scientific problem.
4. Decompose a problem into modules and use functions to implement the modules.
5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
6. Develop applications using file I/O.

UNIT -I
Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.
Introduction to programming: Programming languages and generations, categorization of high-level languages.
Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence, and associativity.

UNIT – II
Introduction to decision control statements: Selective, looping, and nested statements.
Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes, Case study using functions and control statements.

UNIT – III
Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting (Selection and Bubble) algorithms, 2-D arrays, matrix operations.
Strings: Introduction, strings representation, string operations with examples. Case study using arrays.

UNIT – IV
Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, dynamic memory allocation, advantages, and drawbacks of pointers.
Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions, and enumerated data types.

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UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.

Preprocessor Directives: Types of preprocessor directives, examples.

Text Books:

1. M.T. Somashekar "Problem Solving with C", 2nd Edition, Prentice Hall India Learning Private Limited 2018
2. AK Sharma, "Computer Fundamentals and Programming", 2nd Edition, University Press, 2018
3. Pradeep Deyand Manas Ghosh, "Programming in C", Oxford Press, 2nd Edition, 2017

Suggested Reading:

1. Byron Gottfried, Schaum's Outline of Programming with C", Mc Graw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Reema Tharaja "Introduction to C Programming", Second Edition, OXFORDPress,2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm.
2. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

Professor and Head Department
Hyderabad-500 075 (T.S.)

20MT C02

LINEAR ALGEBRA & CALCULUS LAB

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	2P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To explain basic operations of matrix algebra.
2. To discuss the behavior of the infinite Series.
3. To discuss the maxima and minima of the functions of two variables
4. To discuss Physical interpretations on Scalars and vector functions.
5. To explain vector line, surface and volume integrals.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the Matrix operations in executing various programmes.
2. Test the convergence and divergence of the infinite Series.
3. Explore the extreme values of functions of two variables.
4. Determine the gradient, divergent and curl of scalar and vector point functions.
5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems

LIST OF EXPERIMENTS:

1. Addition and multiplication of higher order matrices.
2. Determinant and Inverse of the matrices
3. Eigen values and Eigenvectors of Matrix.
4. Nature of quadratic form of Matrix.
5. Solution of system of linear equations.
6. Data plotting (2D,3D)
7. Test the convergence of infinite series
8. Examine the extreme values of given function
9. Examine the rotational, irrotational and divergence of the flows
10. Verify inter connection between vector theorems (Green's, Gauss and Stoke's Theorems)

Text Books / Suggested Reading / Online Resources:

1. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
2. https://www.scilab.org/tutorials\
3. https://nptel.ac.in/courses/106102064/
4. https://www.udemy.com/algorithms-and-data-structures-in-python/

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20EG C02

ENGLISH LAB
(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives: This course will introduce the students:

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behavior while developing their ability to discuss in groups and making oral presentations.

Course Outcomes: After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams, and discuss and participate in Group discussions.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm &Intonation:** Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material
6. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary –** weaving an imaginative story around a given picture.
9. **Information Gap Activity –** Writing a brief report on a newspaper headline by building on the hints given
10. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt. Ltd., 2011
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016

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20PY C03

OPTICS AND SEMICONDUCTOR PHYSICS LAB

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block chain Technology))

Instruction	4 Periods / week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

Course Objectives: The objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments
2. Understand the behaviour of the light experimentally
3. Analyze the conduction behaviour of semiconductor materials and optoelectronic devices

Course Outcomes: At the end of the course, the student will be able to

1. Interpret the errors in the results of an experiment.
2. Demonstrate physical properties of light experimentally
3. Make use of lasers and optical fibers for engineering applications
4. Explain the V-I characteristics of some optoelectronic and semiconductor devices
5. Find the applications thermistor

Experiments

1.	Error Analysis	:	Estimation of errors in the determination of time period of a torsional pendulum
2.	Fresnel's Biprism	:	Determination of wavelength of given monochromatic source
3.	Newton's Rings	:	Determination of wavelength of given monochromatic source
4.	Single Slit Diffraction	:	Determination of wavelength of given monochromatic source
5.	Diffraction Grating	:	Determination of wavelengths of two yellow lines of light of mercury lamp
6.	Laser	:	Determination of wavelength of given semiconductor laser
7.	Holography	:	Recording and reconstruction of a hologram
8.	Optical Fiber	:	Determination of numerical aperture and power losses of given optical fiber
9.	Energy Gap	:	Determination of energy gap of given semiconductor
10.	P-N Junction Diode	:	Study of V-I characteristics and calculation of resistance of given diode in forward bias and reverse bias
11.	Thermistor	:	Determination of temperature coefficient of resistance of given thermistor
12.	Hall Effect	:	Determination of Hall coefficient, carrier concentration and mobility of charge carriers of given semiconductor specimen
13.	LED	:	Study of I-V characteristics of given LED
14.	Solar Cell	:	Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance
15.	Planck's Constant	:	Determination of Planck's constant using photo cell

NOTE: A minimum of TWELVE experiments should be conducted

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20CS C02

PROGRAMMING FOR PROBLEM SOLVING LAB
(Common to All Programs)

Instruction	4 Periods per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

Course Objectives: The objectives of this course are

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and setup program development environment.
2. Design and test programs to solve mathematical and scientific problems.
3. Identify and rectify the syntax errors and debug program for semantic errors
4. Implement modular programs using functions.
5. Represent data in arrays, pointers, structures and manipulate them through a program.
6. Create, read, and write to and from simple text files.

Lab experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

Text Books:

1. Pradeep Dey and Manas Ghosh, “Programming in C”, Oxford Press, 2nd Edition, 2017.
2. Reema Tharaja “Introduction to C Programming”, Second Edition, OXFORD Press, 2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

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20ME C01

CAD AND DRAFTING

Instruction	1 T + 3 D Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives:

1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

Outcomes: At the end of the course, the Students are able to

1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

List of Exercises:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice versa.

Text Books:

1. N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishers, 2012.
2. K.Venugopal, “Engineering Drawing and Graphics + AutoCAD”, New Age International Pvt. Ltd, 2011.
3. Basanth Agrawal and C M Agrawal, “Engineering Drawing”, 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., “Engineering Drawing”, 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011.

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20MBC02

COMMUNITY ENGAGEMENT

Instruction	3 Hours per week (30 hours field work & 2 hours per week)
SEE	Nil
CIE	50 Marks
Credits	1.5 Credits

Course Objectives: The main Objectives of this Course are to:
1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

Course Outcomes: After the completion of this Course, Student will be able to:
1. Gain an understanding of Rural life, Culture and Social realities.
2. Develop a sense of empathy and bonds of mutuality with Local Communities.
3. Appreciate significant contributions of Local communities to Indian Society and Economy.
4. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
5. Utilise the opportunities provided by Rural Development Programmes.

Module I Appreciation of Rural Society

Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

Module II Understanding Rural Economy and Livelihood

Agriculture, Farming, Landownership, Water management, Animal Husbandry, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III Rural Institutions

Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees, Local Civil Society, Local Administration.

Module IV Rural Development Programmes

History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

Text Books:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

Journals:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of II Semester of B.E. – Computer Science & Engineering as per AICTE Model Curriculum 2020-21

B.E. - COMPUTER SCIENCE AND ENGINEERING

SEMESTER -II

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20MT C03	Differential Equations & Transform Theory	3	-	-	3	40	60	3
2	20CYC01	Chemistry	3	-	-	3	40	60	3
3	20CS C05	Industry 4.0	3	-	-	3	40	60	3
4	20CS C03	Object Oriented Programming	3	-	-	3	40	60	3
PRACTICAL									
5	20MT C04	Differential Equations &Transform Theory Lab	-	-	2	3	50	50	1
6	20CYC02	Chemistry Lab	-	-	4	3	50	50	2
7	20CSC04	Object Oriented Programming Lab	-	-	2	3	50	50	1
8	20ME C02	Workshop / Manufacturing Practice			5	3	50	50	2.5
9	20ME C03	Engineering Exploration	90 Hours / 4P			-	50	-	1.5
TOTAL			**12**	**-**	**13**	**-**	**410**	**440**	**20**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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20MT C03

DIFFERENTIAL EQUATIONS &TRANSFORM THEORY
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IOT &Cyber Security including Block Chain Technology))

Instruction	3 L per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss the properties of Legendre's Polynomials and Bessel's functions
4. To explain the Z-Transform and InverseZ-Transforms.
5. To discuss Fourier transform for solving engineering problems.

Course Outcomes:

Upon completing this course, students will be able to:

1. Calculate the solutions of first order linear differential equations.
2. Calculate the solutions of higher order linear differential equations.
3. Examine the series solutions for higher order differential equations.
4. Evaluate the Improper integrals by Fourier Transform.
5. Solve the difference equations byZ-transforms.

UNIT - I

Differential Equations of First Order: Exact Differential Equations, Equations Reducible To Exact Equations, Linear Equations, Bernoulli's Equations, Riccati's and Clairaut's Equations, Orthogonal trajectories.

UNIT-II

Higher Order Linear Differential Equations: Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Cauchy's homogeneous linear equation. applications: LR and LCR circuits.

UNIT-III

Series Solutions of Differential Equations: Ordinary point, singular point and regular singular point, Series solution when **x=a** is an ordinary point of the equation. Legendre's equation, Legendre's Polynomial of first kind (without proof), Rodrigue's formula, orthogonality of Legendre polynomials. Bessel's equation, Bessel's function of the first kind of order n (without proof), recurrence formulae for **Jn(x)** and related problems (i.eJ0(x), J1(x), J1/2(x), J-1/2(x), J3/2 (x), J-3/2(x)).

UNIT-IV

Fourier Transforms: Fourier integral theorem (statement), Complex form of Fourier integrals. Fourier transforms, Inverse Fourier Transforms, Fourier Sine and Cosine transforms, Inverse Fourier Sine and Cosine Transforms. Properties of Fourier transforms: Linear property, change of scale property, shifting property and Modulation theorem.

UNIT-V

Z-Transforms: Definition, some standard Z-transforms, linearity property, damping rule, shifting U_n to the right, shifting U_n to the left, multiplication by 'n', initial and final value theorems. Inverse Z-Transform: evaluation of Inverse Z-transform by Convolution theorem, partial fractions method. Z- Transform application to difference equations.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley& Sons, 2006.
3. R.K.Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.

Suggested Reading:

1. N.P.Bali and Manish Goyal, Atext book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. A.R.Vasishtha, and R.K.Guptha Integral transforms, Krishna Prakashan Media, Reprint, 2016

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20CY C01

CHEMISTRY

(Common to all branches)

Instruction:	3Hours per Week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE	40 Marks
Credits:	3

Course Objectives

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

Course Outcomes

At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

UNIT-I Atomic and molecular structure and Chemical Kinetics:

Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2 , He_2^+ ,N_2 , O_2 , O_2^- , CO, NO). Pi- molecular orbitals of benzene and its aromaticity.

Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction-Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, – Reference electrodes (NHE, SCE)-electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations. Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.
Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages.
Construction, working & applications of methanol-oxygen fuel cell.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism - Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid) & Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.

Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)

Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)
Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides)
Cyclization (Diels - Alder reaction)

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process),ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V Engineering Materials and Drugs:
Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber). Conducting polymers- Definition, classification and applications.
Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography.
Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation-Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle).
Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition (2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla, Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Readings:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

20CS C05

INDUSTRY 4.0

Instruction	3 Hours per week
Duration of End Examination	3Hours
SEE	60 Marks
CIE	40Marks
Credits	3

Prerequisite: Nil. No prior technical background is required

Course Objectives: The main objectives of this course are to:
1. Offer the students an introduction to Industry 4.0 and its applications to in the business world
2. Give deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges

Course Outcomes: On successful completion of this course, students will be able to:
1. Identify the key drivers and enablers of Industry4.0
2. Describe the smartness in smart factories, smart cities, smart products, ad smart services
3. Determine various systems used in manufacturing plants, and their role in an Industry 4.0world
4. Illustrate the power of Cloud Computing in a networked economy
5. Understand the opportunities, challenges, brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits

UNIT-1
Introduction to Industry 4.0: Various Industrial revolutions, Digitalization and the networked economy, drivers, enablers, compelling forces and challenges for Industry 4.0,Mega trends, Tipping points, comparison of Industry 4.0 Factory and Today's Factory, trends of industrial Big Data and predictive analytics for business transformation

UNIT-2
Road to Industry 4.0: Internet of Things(IoT) and Industrial Internet of Things (IIoT) and Internet of Services, smart manufacturing, smart devices and products, smart logistics, smart cities, predictive analytics

UNIT-3
Related disciplines, systems, technologies for enabling Industry 4.0: Cyber physical systems, robotic automation and collaborative robots, support system for Industry 4.0, mobile computing, related disciplines, Cyber security, Augmented Reality and Virtual Reality, Artificial Intelligence

UNIT-4
Role of data, information, knowledge and collaboration: Resource-based view of a firm, data as a new resource for organizations, harnessing and sharing knowledge in organizations, cloud computing basics, cloud computing and Industry 4.0

UNIT-5
Other Applications and Case Studies: Industry 4.0 laboratories, IIoT case studies, Opportunities and challenges, future of works and skills for workers in the Industry 4.0 era, strategies for competing in an Industry world

Text Book:
1. Klaus Schwab. The Fourth Industrial Revolution. 2017. Portfolio Penguin.
2. Pranjal Sharma. India Automated: How the Fourth Industrial Revolution is Transforming India. 2019. Macmillan; 1edition
3. https://swayam.gov.in/nd1_noc20_cs69/preview

Suggested Reading:
1. Bruno S. Sergi, Elena G. Popkova, Aleksei V. Bogoviz, Tatiana N. Litvinova. Understanding Industry 4.0: AI, the Internet of Things, and the Future of Work. 2019. Emerald Publishing Limited. ISBN: 9781789733129
2. Dominik T. Matt, Vladimír Modrák, Helmut Zsifkovits. Industry 4.0 for SMEs: Challenges, Opportunities and Requirements. Palgravemacmillan

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20CS C03

OBJECT ORIENTED PROGRAMMING

Instruction	3 Periods per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Describe the principles of Object-Oriented Programming.
2. Enable the students to solve problems using OOPs features.
3. Debugging in programs and files.
4. Use of library modules to develop GUI applications.

Course Outcomes: On Successful completion of the course, students will be able to

1. Demonstrate the concepts of Object-Oriented Programming languages to solve problems.
2. Apply the constructs like selection, repetition, functions and packages to modularize the programs.
3. Design and build applications with classes/modules.
4. Find and rectify coding errors in a program to assess and improve performance.
5. Develop packages for solving simple real world problems.
6. Analyze and use appropriate library software to create graphical interface, mathematical software.

Unit-I

Introduction to Object Oriented Programming : Computer Programming and Programming Languages, Programming Paradigms, Features of Object Oriented Programming, Merits and Demerits of OOPs

Basics of Python Programming: Features of Python, Variables, Identifiers, Data types, Input/ Output operations, Operators and Expressions, Operations on Strings, Type Conversion.

Unit-II

Decision Control Statement : Selection/Conditional Branching, Loop Control Structures, Nested Loops. **Functions and Modules**: Uses of functions, Function definition, function call, Variable scope and Lifetime, Recursion, Lambda functions, map, reduce and filter built-in functions, Recursive Functions, Modules, Packages.

Unit-III

Classes and Objects: Introduction, Classes and Objects, init method, Class variables, and Object variables, Public and Private Data members, calling methods from other methods, built-in class attributes, garbage collection, class methods, static methods.

Unit-IV

Inheritance: Introduction, Inheriting classes, Polymorphism and method overloading, Composition or Containership, Abstract classes and inheritance.

Operator Overloading: Introduction, Implementation of Operator Overloading, Overriding.

File Handling: File types, opening and closing files, reading and writing files, file positions, Regular Expressions.

Unit-V

Error and Exception Handling: Introduction to errors and exceptions, Handling Exceptions, Simple GUI Programming with *tkinter* package, Sample Graphics using *Turtle*, Plotting Graphs in Python.

Text Books:

1. Reema Thareja, "Python Programming", Oxford Press, 2017.
2. Mike Mc Grath "Python in easy steps: Makes Programming Fun", Kindle Edition, 2017.

Suggested Readings:

1. Mark Lutz "Learning Python", O'Reilly Media Inc., 5thEdition2013
2. Mark Summerfield "Programming in Python 3: A Complete Introduction to the Python, Addison–Wesley, 2nd Edition.

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References:

1. https://anandology.com/python-practice-book/object_oriented_programming.html
2. http://python-textbok.readthedocs.io/en/1.0/Object_Oriented_Programming.html
3. http://www.tutorialspoint.com/python/python_classes_objects.html
4. https://docs.python.org/3/

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20MT C04

DIFFERENTIAL EQUATIONS &TRANSFORM THEORY LAB
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IOT & Cyber Security including Block Chain Technology)

Instruction	2P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss the properties of Legendre’s Polynomials and Bessel’s functions
4. To explain the Z-Transform and InverseZ-Transforms.
5. To discuss Fourier transform for solving engineering problems.

Course Outcomes:

Upon completing this course, students will be able to:

1. Explore all the possible solutions of first order differential equation.
2. Analyse the solutions of higher order linear differential equations.
3. Examine the series solutions for higher order differential equations.
4. Evaluate the Improper integrals by Fourier Transform.
5. Apply the Z-transform to solve the difference equations.

List of Programmes:

1. Solution of first order liner differential equations.
2. Solution of first order non liner differential equations
3. Geometrical view of Particular integral of higher order differential equations.
4. Simulations of Legendre’s differential equations.
5. Geometrical view of Rodrigue’s theorem.
6. Simulations of Bessel’s first kind solution.
7. Solutions of Bessel’s first kind
   (i.e. $J_0(x)$, $J_1(x)$, $J_{1/2}(x)$, $J_{3/2}(x)$, $J_{-1/2}(x)$, $J_{-3/2}(x)$)
8. Waveform generation continuous signals
9. Computation of Fourier Transformations
10. Discrete Cosine Transforms
11. Digitization of continuous functions.

Text Books / Suggested Reading / Online Resources:

1. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
2. https://www.scilab.org/tutorials\
3. https://nptel.ac.in/courses/106102064/
4. https://www.udemy.com/algorithms-and-data-structures-in-python/

with effect from the Academic Year 2020-21

20CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	4 Hours per Week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	2

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theorical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes

At the end of the course student will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

Chemistry Lab

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2}& Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

Text Books:

1. J. Mendham and Thomas , "Vogel's text book of quantitative chemical analysis", Pearson education Pvt. Ltd. New Delhi , 6th ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg & A.Gulati,; R. Chand & Co. : New Delhi (2011).

Suggested Readings:

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

20CS C04

OBJECT ORIENTED PROGRAMMING LAB

Instruction	2 Periods per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives: The objectives of this course are
1. Identification and installation of required software to work with Python.
2. Program development using OOPs concepts.
3. Handling of errors in program code.
4. Use of library modules to develop GUI applications.

Course Outcomes: On Successful completion of the course, students will be able to
1. Inspect and identify suitable programming environment to work with Python.
2. Choose appropriate control constructs, data structures to build the solutions.
3. Develop the solutions with modular approach using functions, packages to enhance the code efficiency.
4. Analyze and debug the programs to verify and validate code.
5. Demonstrate use of STLs and modules to build graphical interfaces, mathematical software.
6. Determine the requirements of real-world problems and use appropriate modules to develop solutions.

Lab Experiments:
1. Installation of any Object Oriented Programming Language and IDE.
2. Simple scripts to demonstrate the use of basic data types and operators.
3. Simple scripts to demonstrate the use of control structures.
4. Functions and Lambda function and parameter passing.
5. Experimentation with Modules.
6. Implementation of classes with attributes and methods.
7. Demonstration of inheritance.
8. Experiments on Overloading.
9. Files and Regular Expressions.
10. Exceptions and built-in tools.
11. Experiments on System interfaces and GUIs.

Text Book:
1. Reema Thareja, "Python Programming", Oxford Press, 2017.

Online Resources:
1. https://vknight.org/cfm/labsheets/04-object-oriented-programming/
2. http://learning-python.com/class/Workbook/x-exercises.htm
3. https://inst.eecs.berkeley.edu/~cs61a/fa14/lab/lab06/#inheritance
4. https://anandology.com/python-practice-book/object_oriented_programming.html
5. http://stanfordpython.com/
6. https://docs.python.org/3/

Professor and Head Department

20ME C02

WORKSHOP / MANUFACTURING PRACTICE

Instruction	5P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive &team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes: At the end of the course, the students are able to

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
3. Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
4. Perform various operations in welding, machining and casting processes.
5. Conceptualize and produce simple device/mechanism of their choice.

List of Exercises

CYCLE 1

Exercises in Carpentry

1. To plane the given wooden piece to required size
2. To make a lap joint on the given wooden piece according to the given dimensions.
3. To make a dove tail-joint on the given wooden piece according to the given dimensions.

Exercises in Tin Smithy

1. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
2. To make a scoop.
3. To make a pamphlet box.

Exercises in Fitting

1. To make a perfect rectangular MS flat and to do parallel cuts using Hacksaw
2. To make male and female fitting using MSflats-Assembly1
3. To make male and female fitting using MSflats-Assembly2

Exercises in House Wiring

1. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch, and wiring of one buzzer controlled by a bellpush
2. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket
3. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- way switches.

CYCLE 2

Exercises in Casting

1. Study of Sand casting process and its applications.
2. Green sand moulding practice for a single piece pattern
3. Green sand moulding practice for a split pattern with a horizontal core

Exercises in Welding

1. Study of gas welding equipment and process. Identification of flames, making of Butt joint with gas welding.
2. Study of Arc welding process, making Butt joint with DCSP,DCRP
3. Study of Arc welding process, making Lap joint with A.C

Exercises in Machine shop

1. Study of Machine Tools like Lathe, Drilling, Milling and Shaper.
2. Facing, Plain turning and Step turning operations on Lathe machine.
3. Knurling and Taper turning on Lathe machine

Open ended Exercise:

1. Student should produce a component /mechanism by applying the knowledge of any one trade or combination of trades.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I, 2008 and Vol. II, 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I", Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

with effect from the Academic Year 2020-21

20ME C03

ENGINEERING EXPLORATION (PRACTICAL)

Instruction	4 Hours per week
Duration of SEE	Nil
SEE	Nil
CIE	50Marks
Credits	1.5

Prerequisites: Nil

Course Outcomes: At the end of the course, the students are able to

1. Understand the role of an engineer as a problem solver.
2. Identify multi-disciplinary approaches in solving an engineering problem.
3. Build simple systems using engineering design process.
4. Analyze engineering solutions from ethical and sustainability perspectives.
5. Use basics of engineering project management skills in doing projects.

UNIT- I

Role of Engineers: Introduction, science, engineering, technology, engineer, scientist, role of engineer, various disciplines of engineering, misconception of engineering, expectations for the 21st century engineer and NBA graduate attributes.

Engineering problems and Design: Multidisciplinary facet of design, pair wise comparison chart, introduction to econometrics system, generation of multiple solution, Pugh chart, motor and battery sizing concepts, introduction to PCB design.

UNIT- II

Mechanisms: Basic components of a mechanism, degrees of freedom or mobility of a mechanism, 4-bar chain, crank rocker mechanism, slider crank mechanism, simple robotic arm building.

Platform-based development: Introduction to programming platforms (Arduino) and its essentials, sensors, transducers and actuators and their interfacing with Arduino.

UNIT- III

Data Acquisition and Analysis: Types of data, descriptive statistics techniques as applicable to different types of data, types of graphs and their applicability, usage of tools (MS-Office /Open Office/ Libre Office / Scilab) for descriptive statistics, data acquisition (temperature and humidity) using sensors interfaced with Arduino, exporting acquired data to spreadsheets, and analysis using representation.

UNIT- IV

Process Management: Introduction to Agile practice, significance of team work, importance of communication in engineering profession, project management tools, checklist, timeline, Gantt chart, significance of documentation.

UNIT -V

Engineering Ethics & Sustainability in Engineering: Identifying Engineering as a profession, significance of professional ethics, code of conduct for engineers, identifying ethical dimensions in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas.

Sustainability in Engineering: Introduction, sustainability leadership, life cycle assessment, carbon foot print.

Text Books:

1. Clive L. Dym, Patric Little, Elizabeth J Orwin, “Engineering Design: A project-based introduction”, 4th edition, Willey.
2. Matthew Python, “Arduino programming for beginners”, Independently published, 2020.
3. Patrick F. Dunn , “Measurement and data Analysis for engineering and science” , thirdedition, 2014.
4. Andrew Stellman, Jennifer Greene, “Head First Agile: A brain-friendly guide to Agile principles, ideas, and real-world practices”, Kindle Edition.

Suggested Reading:

1. Charles B. Fleddermann, "Engineering ethics", fourth edition, Prentice Hall, 2012.
2. Rob Lawlor, "Engineering in society", second edition, Royal academy of engineering.
3. Richard Dodds, Roger Venables, "Engineering for sustainable development: Guiding principles", The Royal Academy of engineering, 2005.
4. Richard S. Paul, "Robot Manipulators: Mathematics, Programming, and Control", MIT Press.

ENGINEERING EXPLORATION ASSESSMENT SCHEME

S. No	Name of the module	Work Hours	Marks	Evaluation
1	Role of Engineers	4	-	Evaluation - I
2	Engineering Design	16	5	
3	Mechanisms	6	3	
4	Engineering Ethics	2	2	
5	Platform-based Development	16	5	Evaluation - II
6	Data Acquisition and Analysis	6	4	Evaluation-III
7	Project Management	4	4	
8	Sustainability in Engineering	6	2	
9	Course Project Reviews	12	20	Final Evaluation
10	Code of conduct	-	5	
	Total	**72**	**50**	

Model Curriculum

B.E Syllabus for III and IV Semester

With effect from 2019-20

Specialization /Branch: Computer Science and Engineering

Chaitanya Bharathi Institute of Technology (A)
Chaitanya Bharathi (P.O), Gandipet
Hyderabad-500075, Telangana State.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTION AND EXAMINATION
III-Semester of B.E, Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER – III

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
THEORY									
1.	18EEC01	Basic Electrical Engineering	3	1	0	3	30	70	4
2.	18CSC07	Data Structures	3	0	0	3	30	70	3
3.	18CSC08	Discrete Mathematics	3	1	0	3	30	70	4
4.	18CSC09	Digital Electronics and Logic Design	3	0	0	3	30	70	3
5.	18MEC09	Principles of Management	3	0	0	3	30	70	3
6.	18CEM01	Environmental Science	2	0	0	2	-	50	0
PRACTICAL									
7.	18EEC02	Basic Electrical Engineering Lab	0	0	2	2	15	35	1
8.	18CSC10	Data Structures Lab	0	0	2	2	15	35	1
9.	18CSC11	Digital Electronics and Logic Design Lab	0	0	2	2	15	35	1
10.	18EGC03	Soft Skills	0	0	2	2	15	35	1
TOTAL			**17**	**2**	**8**		**210**	**540**	**21**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

18EE C01

BASIC ELECTRICAL ENGINEERING

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives: The objectives of this course are
1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.
3. To understand the basic concepts of Transformer.
4. To understand the basic concepts of DC machines and AC machines.
5. To know about different types of electrical wires and cables and to understand safety rules and methods of earthing.

Course Outcomes: On Successful completion of the course, students will be able to
1. Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits
2. Acquire the concepts of principle of operation of Transformers and DC machines
3. Acquire the concepts of principle of operation of DC machines and AC machines
4. Acquire the knowledge of electrical wiring and cables and electrical safety precautions
5. Recognize importance of earthing and methods of earthing and electrical installations

UNIT-I: DC Circuits
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of firstorder RL and RC circuits.

UNIT-II: AC Circuits
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III: Transformers
Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation, Auto transformer.

UNIT-IV: DC and AC Machines
DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators. DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors. Three - Phase Induction Motors: Construction, Principle of operation, Torque equation, torque-slip characteristics, Power stages, speed control of induction motors.

UNIT-V: Electrical Installations and Electrical Wiring
Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules.
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Earthing, Elementary calculations for energy consumption.

Text books:
1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:
1. D. P. Kothari & I. J. Nagrath, –Basic Electrical Engineering Tata McGraw Hill, 2010.
2. V. D. Toro, –Electrical Engineering Fundamentals Prentice Hall India, 1989.
3. D.C. Kulshreshtha, –Basic Electrical Engineering McGraw Hill, 2009
4. P.V.Prasad, S.sivanagaraju, R.Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013.

18CS C07

DATA STRUCTURES

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives: The objectives of this course are

1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different balanced binary trees, which provides efficient implementation for data structures.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand the basic concepts of data structures.
2. Analyze the performance of algorithms.
3. Distinguish between linear and non-linear data structures.
4. Identify the significance of balanced search trees.
5. Establish a suitable data structure for real world applications.

UNIT - I

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff. **Recursion**: Introduction, format of recursive functions, recursion Vs. Iteration, examples. **Sorting:** Quick sort, Merge Sort, Selection Sort

UNIT - II

Linked Lists: Introduction, Linked lists, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays, Types of Linked Lists and operations-Circular Single Linked List, Double Linked List, Circular Double Linked List

UNIT- III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications

UNIT - IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Binary Trees, Tree Traversal. **Binary Search Trees:** Representation and operations. **Heap Tree:** definition, representation, Heap Sort. **Graphs:** Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.

UNIT - V

Hashing: Introduction, Hashing Functions- Modulo, Middle of Square, Folding, Collision Techniques-Linear Probing, Quadratic Probing, Double Hashing, **Balanced Search Trees:** AVL Trees, Red-Black Trees, Splay Trees, B-Trees

Text Books:

1. Narasimha karumanchi, "Data Structures and Algorithms Made Easy", Career Monk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, "Fundamentals of Data structures in C", E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, "Data Structures using C", Oxford University Press.

Suggested Reading:

1. D.S.Kushwaha and A.K.Misra, "Data structures A Programming Approach with C", PHI.
2. Seymour Lipschutz, "Data Structures with C", Schaums Outlines, Kindle Edition

Online Resources:

1. https://www.tutorialspoint.com/data_structures_algorithms/ index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data- structures-1#DS

Professor and Head Department

18CS C08

DISCRETE MATHEMATICS

Instruction	3L+1T Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objectives of this course are

1. To provide theoretical foundations of computer sciences.
2. To develop an understanding of logic, set theory, counting, functions, relations and proof techniques.
3. To familiarize with algebraic systems and graph theory.

Course Outcomes: On Successful completion of this course, student will be able to

1. Apply Propositional and Predicate logic for problem solving in various domains.
2. Understand Set Theory, Relations, Functions and Lattices as partially ordered sets.
3. Model and solve the real world problems using Generating Functions and Recurrence Relations.
4. Understand and apply the principles of graphs and trees to simple applications.
5. Study Algebraic systems and their general Properties.

UNIT - I

Fundamental Principles of counting: The Rules of Sum and Product, permutations, Combinations. **Introduction to Propositional Calculus**: Basic Connectives and Truth tables, Logical Equivalence: Laws of Logic, Logical Implication; Rules of Inference. **Predicates**: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.

UNIT - II

Sets: Sets and Subsets, Operations on sets and the Laws of Set Theory, Counting and Venn Diagrams. **Relations and Functions:** Cartesian Products and Relations, Functions: Composition of functions, one-one, Onto and Inverse of functions, Pigeon hole principle, partial ordering relations, POSET, Hasse diagrams, Lattices as Partially Ordered Sets, Equivalence relations.

UNIT- III

Generating Functions: Binomial Theorem, Generating Functions, Calculating Coefficient of generating functions.
Recurrence Relations: The First Order Linear Recurrence Relation, Second Order Linear. Homogeneous Recurrence relations with constant coefficients, Non Homogeneous Recurrence relations

UNIT - IV

Introduction to Graphs: Graphs and their basic properties - degree, path, cycle, Sub graphs, Complements and Graph Isomorphism, Euler trails and circuits, Hamiltonian paths and cycles, planar graphs, Euler formula, Graph Coloring and Chromatic polynomial. **Trees**: Definitions, Properties, Rooted Trees, Spanning Trees, Minimum Spanning trees: The Algorithms of Kruskal and Prims.

UNIT - V

Algebraic Structures: Algebraic Systems: Examples and General Properties, Semi groups and Monoids. **Groups:** Definitions and Examples, Subgroups, Homomorphisms and cyclic groups.

Text Books:

1. Ralph P. Grimaldi, “Discrete and Combinatorial Mathematics”, An Applied Introduction, 4th edition, Pearson Education, 2003.
2. R.K.Bisht, H.S.Dhami, “Discrete Mathematics”, Oxford University Press, Published in 2015.

Suggested Reading:

1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, 7th edition, Tata McGraw-Hill, 2005
2. J.P. Tremblay, R.Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, TATA McGraw-Hill Edition, 1995.
3. Joe L.Mott, Abraham Kandel, Theodore P. Baker, “Discrete Mathematics for Computer Scientists & Mathematicians”, 2nd Edition, PHI, 1986.
4. David D.Railey, Kenny A. Hunt, “Computational Thinking for the Modern Problem Solving”, CRC Press, 2014.

Online Resources:

1. https://nptel.ac.in/courses/111107058/
2. https://nptel-discrete-mathematics-5217

18CS C09

DIGITAL ELECTRONICS AND LOGIC DESIGN

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To understand the architecture of basic building blocks, logic gates and minimization techniques including Quine-Mcclusky method.
2. To analyze and design the Combinational and Sequential circuits.
3. To familiarize the notations of HDL descriptions in Verilog.

Course Outcomes: On Successful completion of this course, student will be able to

1. Familiarize with number systems, simplification of Boolean functions.
2. Manipulate simple Boolean expressions using maps and tabulation method.
3. Design basic digital circuits in Computer Hardware and Digital system.
4. Use high level HDLs such as Verilog for the design of Combinational and Sequential circuits.
5. Configure registers and counters for different applications.

UNIT - I

Digital Systems and Binary Numbers: Digital systems, Binary numbers, Number base conversions, Octal and Hexadecimal numbers, Complements of Numbers, Binary codes. **Boolean Algebra and logic Gates:** Binary logic, Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates, Integrated Circuits.

UNIT - II

Minimization of Switching Functions: Introduction, the map method, minimal functions and their properties, the tabulation procedure, the prime implicant chart. **NAND and NOR Gates**: NAND Circuits, Two-level Implementation, Multilevel NAND Circuits, NOR Circuits. **Exclusive OR Gates**: Odd Function, Parity Generation and Checking.

UNIT- III

Combinational Logic Design: Combinational Circuits. **Analysis Procedure:** Derivation of Boolean Functions, Derivation of the Truth Table, Logic Simulation. **Design Procedure:** Decoders, Encoders, Multiplexers, Binary Adders, Adder- Subtractor, Binary Multiplier, HDL Representations – Verilog.

UNIT - IV

Sequential Circuits: Sequential circuit definitions, Latches, Flip-Flops, sequential circuit analysis, sequential circuit design, design with D Flip-Flops, designing with JK Flip-Flops, HDL representation for sequential circuits - Verilog.

UNIT - V

Registers: Registers, Shift registers. **Counters**: Ripple Counters, Synchronous Binary counters, Other Counters. **Memory and Programmable Logic**: Introduction, Random-Access Memory, Memory Decoding, Error Detection and Correction, Read-Only Memory, Programmable Logic Array (PLA), Programmable Array Logic (PAL).

Text Books:

1. Morris Mano M. and Michael D.Ciletti, “Digital Design, With an Introduction to Verilog HDL”, Pearson 5th edition, 2013.
2. ZVI Kohavi, “Switching and Finite Automata Theory”, Tata McGraw Hill 2 edition, 1995.

Suggested Reading:

1. H.T. Nagle, “Introduction to Computer logic”, Prentice Hall 1975.
2. Stephen Brown, Zvonko Vranesic, “Fundamentals of Digital Logic with VHDL design, McGraw Hill 2nd Edition, 2009.

18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are to
1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

Course Outcomes: On Successful completion of this course, student will be able to
1. Get an exposure to common electrical components and their ratings
2. Make electrical connections by wires of appropriate ratings
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer
6. Understand the basic characteristics of dc and ac machines

UNIT - I

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, companies, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT - II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT- III

Organizing: Nature and purpose of Organizing, formal and informal organizations, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT - IV

Directing: Individual and group behavior, motivation, theories of motivation, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT - V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, "Management", 10/e., Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, "Management", 6/e., Pearson Education, 2004.

Suggested Reading:

1. P.C. Tripathy & P.N. Reddy, "Principles of Management", Tata McGraw Hill, 1999
2. Harold Koontz and Cyril O'Donnell "Principles of Management", Tata McGraw Hill, 2017

Professor and Head Department

18CE M01

ENVIRONMENTAL SCIENCE
(MANDATORY COURSE)

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: The objectives of this course are
1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance.
3. To identify the importance of interlinking of food chain.
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: On successful completion of this course, student will be able to
1. Define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. Relate the social issues and the environment and contribute for the sustainable development.
4. Follow the environmental ethics.
5. Contribute for the mitigation and management of environmental disasters.

UNIT - I

Environmental Studies: Definition, Scope And Importance, Need For Public Awareness. Natural resources: Use And Over Utilization of Natural Resources - Water Resources, Food Resources, Forest Resources, Mineral Resources, Energy Resources, Land Resources.

UNIT - II

Ecosystems: Concept of an Ecosystem, Structure And Function of an Ecosystem, Role of Producers, Consumers And Decomposers, Energy Flow in an Ecosystem, Food Chains, Food Webs, Ecological Pyramids, Nutrient Cycling, Bio-Geo Chemical Cycles, Terrestrial And Aquatic Acosystems.

UNIT- III

Biodiversity: Genetic, Species And Ecosystem Biodiversity, Bio-Geographical Classification of India, India as a Mega Diversity Nation. Values of Biodiversity, Hot-Spots of Biodiversity, Threats to Biodiversity, Endangered And Endemic Species of India, Methods of Conservation of Biodiversity

UNIT - IV

Environmental Pollution: Cause, Effects And Control Measures of Air Pollution, Water Pollution, Marine Pollution, Soil Pollution, Noise Pollution And Solid Waste Management, Nuclear Hazards. Environmental Legislations: Environment Protection Act, Air, Water, Forest & Wild Life Acts, Issues Involved in Enforcement of Environmental Legislation, Responsibilities of State And Central Pollution Control Boards.

UNIT - V

Social issues and the environment: Water Conservation Methods: Rain Water Harvesting And Watershed Management, Environmental Ethics, Sustainable Development and Climate Change: Global Warming, Ozone Layer Depletion, Forest Fires, And Contemporary Issues.

Text Books:
1. Y. Anjaneyulu, “Introduction to Environmental Science”, B S Publications, 2004.
2. Suresh K. Dhameja, “Environmental Studies”, S. K. Kataria& Sons, 2009.

Suggested Reading:
3. C. S. Rao,” Environmental Pollution Control Engineering”, Wiley, 1991.
4. S. S. Dara, “A Text Book of Environmental Chemistry &Pollution Control”, S. Chand Limited, 2006.

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18EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives: The objectives of this course are

1. To verify the basic electrical circuit laws and theorems.
2. To determine the parameters and power factor of a coil.
3. To calculate the time and frequency responses of RLC circuits
4. To determine the characteristics of Transformers.
5. To determine the characteristics of dc and ac machines.

Course Outcomes: On Successful completion of the course, students will be able to

1. Make electrical connections by wires of appropriate ratings.
2. Understand the circuit analysis techniques.
3. Determine the parameters of the given coil.
4. Understand the basic characteristics of transformer.
5. Understand the basic characteristics of dc and ac machines.

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components
2. Verification of KCL and KVL.
3. Time response of RL and RC circuits.
4. Calculation of parameters of a choke coil by Wattmeter Method.
5. Verification of Thevenin's and Norton's theorems.
6. Turns ratio /voltage ratio verification of 1-Ph Transformers.
7. OC and SC tests on a given 1-Ph Transformer.
8. Observation of Excitation Phenomenon in Transformer.
9. Measurement of 3-Ph power in a balanced system (By 2- Wattmeter method).
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle).
11. Load test of DC Shunt motor.
12. Speed control of DC Shunt motor.
13. Load test of 3-Ph Induction motor.
14. Demonstration of LT Switchgear Equipment/Components.
15. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: At least **TEN** experiments should be conducted in the semester.

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18CS C10

DATA STRUCTURES LAB

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Pre-requisites: Any Programming Language(C/Python)

Course Objectives: The objectives of this course are to:
1. Understand basic concepts data structures and abstract data types.
2. Differentiate between linear and non-linear data structures.
3. Analyze various searching, sorting and hashing techniques.

Course Outcomes: On Successful completion of the course, students will be able to
1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Implement non-linear data structures such as trees, graphs.
4. Analyze various searching and sorting techniques.
5. Design and develop real world problem using suitable data structures.

List of Experiments
1. Implementation of Quick Sort, Merge Sort, Selection Sort.
2. Implementation of Insert, Delete and Search operations on Single Linked List.
3. Implementation of Insert, Delete and Search operations on doubly Linked List.
4. Implementation of Stack using array and linked list.
5. Converting of Infix Expression to Postfix.
6. Implement the algorithm for Evaluation of Postfix.
7. Implementation of Queue using array and linked list.
8. Implementation of Binary Tree Traversals.
9. Implementation of Binary Search Tree.
10. Implementation of Heap Sort.
11. Implementation of Graph Traversal Techniques.
12. Implementation of Hashing.

Text Books

1. Brian W Kernighan, Dennis Ritchie, "C Programming Language", PH PTR, 2nd Edition.
2. Richard M Reese, "Understanding and Using C Pointers", O`Reily, 2013.

Online Resources:
1. https://nptel.ac.in/courses/106102064/
2. https://www.udemy.com/algorithms-and-data-structures-in-python/

18CS C11

DIGITAL ELECTRONICS AND LOGIC DESIGN LAB

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The objectives of this course are
1. To simulate and synthesize combinational logic circuits.
2. To simulate and synthesize sequential logic circuits.
3. To write a test bench for verifying the functionality and implement procedures for any digital design.

Course Outcomes: On Successful completion of this course, student will be able to
1. Design a Digital circuit using Verilog HDL.
2. Understand various abstraction levels of a digital design.
3. Verify the functionality of a design using Test bench.
4. Simulate and synthesize combinational logic circuits.
5. Simulate and synthesize sequential logic circuits.

Write a Verilog HDL to Simulate and synthesize the following
1. Implement operators and operands using Verilog.
2. Logic Gates: AND, OR, BUFFER.
3. Arithmetic Units: Adders and Subtractors.
4. Magnitude Comparator, BCD to Excess 3, BCD to 7-segment display.
5. Multiplexers and De-multiplexers.
6. Encoders, Decoders, Priority Encoder.
7. Implementation of logic function using Multiplexers and Decoders.
8. Implementation of Ripple Carry Adder.
9. Flip-Flops.
10. Design of Synchronous Counters.

Text Book:
1. Samir Palnitkar, "Verilog HDL, A guide to Digital design and synthesis", 2/e, Pearson Education, 2008.

Suggested Reading:
1. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL", PHI, 2005.

18EG C03

SOFT SKILLS

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The objectives of this course are:
1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: On Successful completion of the course, students will be able to
1. Be effective communicators and participate in group discussions and case studies with confidence. Also be able to make presentations in a professional context.
2. Write Resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
4. Make the transition smoothly from Campus to Corporate. Also use media with etiquette and know what academic ethics are.
5. To do a live, mini project by collecting and analyzing data and making oral and written presentation of the same.

Exercise 1
Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion),
Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise).

Exercise 2
Main Topics: Advanced Group Discussion with Case studies: Dynamics of group discussion, intervention, summarizing and modulation of voice, body language, relevance, fluency and coherence. **Flipped Sessions:** Importance of Professional Updating & Upgrading (Reading & Discussions).**Writing Input:** Writing with Precision - Writing Abstracts.

Exercise 3
Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions &Practice), **Writing Input:**
Writing to Reflect - Resume Writing.

Exercise 4
Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity, **Flipped Sessions:** Corporate Culture, Etiquette & Grooming (Video Sessions and Practice through Role-play), **Writing Input:** Writing to Define - Writing an effective SOP.

Exercise 5
Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar.Elements and Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props and PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation), **Writing Input:** Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007.
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006.
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010.
4. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004.
5. Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:
1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION
IV-Semester of B.E, Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER – IV

S.No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L	T	P/D	Duration of SEE in Hours	Scheme of Examination: Maximum Marks CIE	SEE	Credits
THEORY									
1	18ECC34	Basic Electronics	3	-	-	3	30	70	3
2	18MTC09	Probability and Statistics	3	1	-	3	30	70	4
3	18CSC12	Computer Architecture and Micro Processor	3	-	-	3	30	70	3
4	18CSC13	Data Base Management Systems	3	-	-	3	30	70	3
5	18EGM01	Indian Constitution and Fundamental Principles	2	-	-	2	-	* 50	0
PRACTICALS									
6	18ECC35	Basic Electronics Lab	-	-	2	2	15	35	1
7	18CSC14	Computer Architecture and Micro Processor Lab	-	-	3	3	25	50	1.5
8	18CSC15	Data Base Management Systems Lab	-	-	3	3	25	50	1.5
9	18CSC16	IT Workshop (Latex/Scilab)	-	1	2	3	25	50	2
		TOTAL	**14**	**2**	**10**	**-**	**210**	**515**	**19**

L: Lecture D: Drawing CIE - Continuous Internal Evaluation
T: Tutorial P: Practical SEE - Semester End Examination

18ECC34

BASIC ELECTRONICS

Instruction	3 L Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge about semiconductor physics and basic electrical engineering.

Course Objectives: The objectives of this course are

1. Describe semiconductor devices principle and to understand the characteristics of junction diode and transistors.
2. Understand working principles of Oscillators and Amplifiers.
3. Understand the working principle of the regulators and transducers.

Course Outcomes: On Successful completion of the course, students will be able to

1. Use semiconductor devices in making circuits like rectifiers, filters, regulators etc.
2. Design amplifier and oscillators
3. Compare various types of power amplifiers.
4. Analyze the principles and practices for instrument design to development the real world Problems.
5. Apply concepts of various electronic circuits.

UNIT – I

Semiconductor Theory: Energy levels, Intrinsic and Extrinsic Semiconductor, Mobility, Diffusion and Drift current, Hall effect, Law of mass action, Characteristics of P-N Junction diode, current equation, Parameters and Applications. **Rectifiers:** Half wave and Full wave Rectifiers Bridge and center tapped with and without filters, Ripple factor, regulation and efficiency.

UNIT – II

Transistors: Bipolar and field effect transistors with their h-parameter equivalent circuits, Basic Amplifiers classification and their circuits (Qualitative treatment only). **Regulators and Inverters**: Zener Diode**,** Breakdown mechanisms, Characteristics, Effect of Temperature, Application as voltage regulator.

UNIT – III

Feedback Amplifiers: Properties of Negative Feedback Amplifier, Types of Negative Feedback, Effect of negative feedback on Input impedance and Output impedance, Applications (Qualitative treatment only).

Oscillators: principle of oscillations, LC Type-Hartley, Colpitt and RC Type- Phase shift, Wien Bridge and Crystal Oscillator (Qualitative treatment only).

UNIT – IV

Operational Amplifiers: Basic Principle, Ideal and practical Characteristics and Applications-Summer, Integrator, Differentiator, Instrumentation Amplifier. **Power Amplifiers:** Operation of Class A, Class B, Class AB and Class C power amplifiers

UNIT – V

Data Acquisition systems: Study of transducers-LVDT, Strain gauge. **Photo Electric Devices and Industrial Devices:** Photo diode, Photo Transistor, LED, LCD, SCR, UJT Construction and Characteristics and their applications only. **Display Systems:** Constructional details of C.R.O and Applications.

Text Books:

1. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuits Theory", Pearson Education, 9^{th}edition, LPE, Reprinted, 2006.
2. Morris Mano, "Digital Design", Pearson Education, Asia 2002.

Suggested Reading:

1. Jacob Millman and C., Halkias, "Electronic Devices", McGraw Hill, Eight Edition, Reprint1985.
2. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Prentice Hall of India, 3rd edition,1985.
3. W. D. Cooper, A. Helfric, "Electronic Instrumentation and Measurement Techniques", PHI, 4th edition,2010.

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18MT C09

PROBABILITY AND STATISTICS
(For CSE and IT)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objectives of this course are
1. To Able to learn and Analyzing data in Linear and Non-Linear form.
2. To Able to fit the hypothetical data using probability distribution.
3. To Understand the data using the testing of Hypothesis.
4. To Able to Analyzing time series data using trend analysis.
5. To Able to formulate and get the solution of real world problem.

Course Outcomes: On Successful completion of the course, students will be able to
1. Use the principle of Least Squares approximating for estimating the value.
2. Use the basic probability for fitting the Random phenomenon.
3. Analyzing data using different methods of hypothesis testing.
4. Use the Moving Averages Methods for trend analysis.
5. Analyze the random phenomena of real world data.

UNIT – I
Basic Statistics: Measures of Central Tendency, Measures of Dispersion, Skewness (SKP & SKB) For Frequency Distribution, Kurtosis, Curve Fitting by The Method of Least Squares, Fitting of Straight Lines, Second Degree Parabola And Growth Curve. ($y = ae^{bx}, y = ax^b$ & $y = ab^x$.)

UNIT – II
Discrete Probability Distributions: Basic Probability, Conditional Probability, Bayes Theorem, Random Variable, Discrete Random Variable, Continuous Random Variable, Properties of Probability Mass Function, Probability Density Function, Mathematical Expectation Variance, Co-Variance And Properties, Poisson Distribution, MGF, CGF, Fitting of Poisson Distribution.

UNIT – III
Continuous Probability Distribution And Bivariate Distribution: Continuous Probability Distribution-Normal Distribution-Standard Normal Random Variable (MGF, Expectation, Variance, Properties of Normal Curve)-Areas Under Normal Curve-Exponential Distribution (MGF, CGF, Expectation, Variance)-Uniform Distribution (MGF, Expectation, Variance)-Bivariate Data Two Dimensional Discrete Random Variable, Continuous Random Variable, Marginal Probability Function, Properties of Joint Probability Function-Sum And Differences.

UNIT – IV
Small Sample Test: Inferential Statistics-Test of Significance-Large Sample Test For Single Proportion, Difference of Proportions, Single Mean, Difference of Means And Differences of Standard Deviations. Small Sample Test-Test For Single Mean, Differences of Means, Test For Ratio of Variances, Chi-Square Test For Goodness of Fit And Independent of Attributes.

UNIT – V
Time Series Analysis and ANOVA: One Way Classification-Assumptions For ANOVA Test-ANOVA For Fixed Effect Model-Two Way Classification-ANOVA For Fixed Effect Model-Components of Time Series-Measurement of Trend - Method of Semi Averages- Moving Averages Method (3 Years And 5 Years).

Text Books:

1. S.C.Gupta, V.K.Kappoor, “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons, 2014.
2. S.C.Gupta, V.K.Kappoor, “Fundamentals of Applied Statistics”, Sultan Chand and Sons, 2014.
3. Sheldon Ross, “A First Course in Probability”, 9th Edition, Pearson publications, 2014.

Suggested Reading:

1. W. Feller, “An Introduction to Probability Theory and its Applications”, Vol. 1, 3rd Ed., Wiley, 1968.

18CS C12

COMPUTER ARCHITECTURE AND MICRO PROCESSOR

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Digital Electronics and Logic Design.

Course Objectives: The objectives of this course are
1. To understand the basic principles of Instruction Level Architecture and Instruction Execution, Memory System Design.
2. To learn various I/O devices and its operations, knowledge on Instruction Level Parallelism.
3. To impart the knowledge on Micro Programming and Pipelining techniques.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand the functional block diagram of single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
2. Design assembly language program for specified computing 16 bit multiplication, division and I/O device interface.
3. Derive flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
4. Design a memory module and analyze its operation by interfacing with the CPU.
5. Apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

UNIT - I

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi-computers. **Arithmetic:** Addition and Subtraction of Signed numbers, Design of fast adders, Multiplication of positive numbers, Signed-Operand Multiplication, Integer Division.

UNIT - II

Basic Processing Unit: Fundamental concepts, Execution of a complete instruction, Multiple-Bus organization, Hardwired control, Micro programmed control. **8086 Architecture:** CPU Architecture, Internal operation, Machine language instructions Addressing modes, Instruction formats, Instruction execution timing.

UNIT- III

Assembly Language Programming: Instruction format, Data transfer instructions, Arithmetic instructions. **Assembly Language Programming:** Branch instructions, Loop instructions, NOP and HLT, Flag manipulation instructions, Logical instructions, Shift and Rotate instructions, Directives and Operators. **Modular Programming:** Linking and Relocation, Stacks, Procedures, Interrupts and Interrupt routines, Macros and String instructions, REP prefix.

UNIT - IV

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers –Program Controlled, Interrupt Driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCSI, USB.
Pipelining: Basic concepts, Data hazards, Instruction hazards, Influence on instruction sets, Data path and control considerations, Superscalar operation, Performance considerations.

UNIT – V

The Memory System: Semiconductor RAM Memories, Cache Memories, Performance considerations, Virtual Memories, Memory Management requirements, Secondary Storage. **Large Computer Systems:** Forms of Parallel Processing, Array Processors, Structure of general purpose multiprocessors, Program parallelism and shared variables.

Text Books:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", 5th Edition, McGrawHill Education Edition 2011.
2. Yu-chengLiu, Glenn A.Gibson, "Microcomputer Systems: The 8086/ 8088 Family", 2nd Edition, PHI Learning 2011.

Suggested Reading:

1. M. M. Mano, "Computer System Architecture", 3rd edition, Prentice Hall, 1994.
2. William Stallings, "Computer Organisation and Architecture, Design for Performance", Pearson, 9th Edition, 2013.
3. Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata McGraw Hill, Revised 2nd Edition, 2007.
4. Brey B.Brey, "The Intel Microprocessor, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro-Processors-Architecture, Programming and Interfacing", 4thEdition, Prentice Hall.

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18CS C13

DATABASE MANAGEMENT SYSTEMS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Discrete mathematics of computer science, Programming and data structures.

Course Objectives: The objectives of this course are

1. To become familiar with fundamental concepts of database management. These concepts include aspects of database design, database languages and database-system implementation.
2. To understand about data storage techniques and indexing.
3. To impart knowledge in transaction management, concurrency control techniques and recovery procedures.

Course Outcomes: On Successful completion of this course, student will be able to

1. Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS.
2. Design the database using ER modeling and Write queries using DDL, DML and DCL of SQL, Relational Algebra and Procedures, Functions using PL/SQL
3. Outline the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.
4. Summarize basic concepts of storage techniques like indexing, hashing and familiar with states and properties of transaction.
5. Illustrate locking, time stamp, graph and validation-based protocols for concurrency control.
6. Relate log based, ARIES recovery techniques to increase the robustness of the database, identify to resolve the deadlocks in the transaction.

UNIT - I

Introduction : Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Users and Administrators, Database System Architecture, Application Architectures.

Database Design and E-R Model: Overview of the Design Process, Data Models, The E-R Model, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Reduction to Relation Schemas.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations.

Structured Query Language: Overviews, SQL Data Types, Basic Structure of SQL Queries, Modification of the Database, Set Operations, Aggregate Functions, Data-Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT- III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization–1NF,2NF and 3 NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

Indexing: Basic Concepts, Primary Index, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files.

UNIT - IV

Hash based Indexing: Static Hashing, Extendible Hashing. **Transaction Management and Concurrency Control:** Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity.

UNIT - V

Deadlocks: Deadlock Prevention, Deadlock Detection and Recovery. **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, ARIES Recovery Method, Remote Backup Systems.

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Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, "An Introduction to Database Systems", Eight Editions, Pearson Education, 2006.
3. Raghu Ramakrishnan, Johnnes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2003.
4. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, "Fundamentals of Database Systems", Fourth Edition, Pearson Education, 2006.

Suggested Reading:

1. J.D.Ullman, "Principles of Database Systems", Galgotia.

Online Resources:

1. http://www.nptelvideos.in/2012/11/database-management- system.html

18EG M01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks
CIE	-
Credits	-

Course Objectives: The objectives of this course are

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: On Successful completion of the course, students will be able to

1. Understand the making of the Indian Constitution, its features and know the importance of Directive Principles of State Policy.
2. Identify the difference between Right to Equality and Right to Freedom and acquires the legal status of Fundamental Duties.
3. Analyze the structuring of the Indian Union, distribution of powers between the Union and the States, and the role and position of President in Union Government.
4. Distinguish between the Lok Sabha and Rajya Sabha in law making while appreciating the importance of Judiciary in interpretation of law.
5. Differentiate between the Municipalities and Panchayats in their structure and functions.
6. Apply the knowledge of Indian Constitution to real-life or professional situation for better civic society

UNIT - I

Constitution of India: Introduction and salient features, Constitutional history, Directive principles of state policy - Its importance and implementation.

UNIT - II

Union Government and its Administration: Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States, Parliamentary form of government in India. **President**: role, power and position.

UNIT- III

Emergency Provisions in India: National emergency, President rule, Financial emergency

UNIT – IV

Local Self Government: District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

UNIT – V

Scheme of the Fundamental Rights & Duties: Fundamental Duties - the legal status.

Scheme of the Fundamental Rights: To Equality, to certain Freedom under Article 19, to Life and Personal Liberty under Article 21.

Text Books:

1. Indian Government & Politics, Ed Prof V Ravindra Sastry, Telugu Akademy, 2nd edition, 2018.
2. Indian Constitution at Work, NCERT, 10th edition, 2018.

Suggested Reading:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition,2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

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18EC C35

BASIC ELECTRONICS LAB

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Prerequisite: Knowledge about semiconductor physics and basic electrical engineering.

Course Objectives: The objectives of this course are
1. Learn about various electronic components and devices.
2. Study the transistor characteristics in different modes.
3. Learn about oscillators and amplifiers.

Course Outcomes: On Successful completion of the course, students will be able to
1. Familiarize on basic electronic components, devices and system.
2. Analyze the measurements of time period, amplitude and phase of different waveforms.
3. Design and analyze the behavior of the regulator and rectifier.
4. Develop various types of oscillators and power amplifiers
5. Design the various circuits using operational amplifiers.

LIST OF EXPERIMENTS:
1. Study of Electronic components.
2. Characteristics of Semiconductor diodes (Ge, Si and Zener).
3. CRO and its Applications.
4. Half, Full wave rectifiers with and without filters.
5. Voltage Regulator using zener diode.
6. Characteristics of BJT in CE Configuration.
7. Characteristics of FET in CS Configuration.
8. Amplifier with and without feedback.
9. RC Phase shift oscillator
10. Operational Amplifier and its applications.
11. Power Amplifiers Characteristics
12. Realization of Half and Full adder

Text Books:

1. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics, a Text - Lab Manual", 7th Edition, TMH, 1994.
2. Paul B. Zbar, "Industrial Electronics, a Text - Lab Manual", 4th Edition, 2008.

18CS C14

COMPUTER ARCHITECTURE AND MICRO PROCESSOR LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Pre-requisites: Digital Electronics and Logic Design, Computer Architecture.

Course Objectives: The objectives of this course are
1. To become familiar with the architecture and Instruction set of 8086 microprocessor.
2. To provide practical hands on experience with Assembly Language Programming.
3. To provide solid foundation on interfacing the external devices to the processor according to the user requirements to create novel products and solutions for the real time problems.

Course Outcomes: On Successful completion of this course, student will be able to
1. Describe the architecture and comprehend the instruction set of 8086.
2. Understand and apply the principles of Assembly Language Programming in developing microprocessor based applications.
3. Get familiarized with different assembly language software tools.
4. Work with standard microprocessor interfaces to know how a processor will communicate with the External world.
5. Design and develop of various Embedded Applications.

LIST OF EXPERIMENTS:
1. Examining and understanding the working nature of internal components of computer like North bridge and South bridge of mother board, Memories like cache, ROM, RAM, Secondary storage devices, understanding CMOS and analyzing configuration using inbuilt or external tools.
2. Implementation of 2's complement to represent signed numbers in C/ Java/Python for a user specified bit length like 8/16 bit.
3. Implementation of Booth's Binary Multiplication algorithm in C/Java/ Python.
4. Implementation of Non restoring Division algorithm in C/Java/Python.
5. Tutorials with 8086 kit / MASM / NASM software tool.
6. Addition of 32-bit numbers using 16-bit registers.
7. Fixed-point multiplication and division.
8. Sorting hexadecimal array.
9. Code conversion from hexadecimal to decimal.
10. Packed and Unpacked BCD numbers.
11. Sum of set of BCD numbers.
12. Searching.
13. Display a string of characters using 8279.

Suggested Reading:

1. Yu-cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086/ 8088 Family", 2nd Edition, PHI Learning 2011.
2. Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata McGraw Hill, Revised 2nd Edition, 2007.
3. B. Brey, "The Intel Microprocessor, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro-Processors-Architecture, Programming and Interfacing", 4th Edition, Prentice Hall, 1993.

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18CS C15

DATABASE MANAGEMENT SYSTEMS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Course Objectives: The objectives of this course are
1. To become familiar with the concepts of structured query language.
2. To understand about programming language / structured query language (PL/SQL).
3. To become familiar with generation of form and open database connectivity.

Course Outcomes: On Successful completion of this course, student will be able to
1. Apply the built-in functions and write simple queries on various databases.
2. Perform definition and manipulation of data using SQL commands.
3. Develop complex queries using joins and nested queries.
4. Add constraints on Databases implement DCL, TCL and advanced SQL commands.
5. Develop programs using cursors, triggers, exceptions, procedures and functions in PL/SQL.

LIST OF EXPERIMENTS:

SQL:
1. Queries using Built-In functions, like aggregate functions, String Functions, Numeric Functions, Data Functions, Conversion Functions and other miscellaneous.
2. Queries using operators in SQL.
3. Queries to Retrieve and Change Data: Select, Insert, Delete and Update.
4. Queries using Group By, Order By and Having Clauses.
5. Queries on Controlling Data: Commit, Rollback and Save point.
6. Queries to Build Report in SQL *PLUS.
7. Queries for Creating, Dropping and Altering Tables, Views and Constraints.
8. Queries on Joins and Correlated Sub-Queries.
9. Queries on Working with Index, Sequence, Synonym, Controlling Access and Locking Rows for Update, Creating Password and Security features.

PL/SQL:
1. Write a PL/SQL code using Basic Variable, Anchored Declarations and Usage of Assignment Operation.
2. Write a PL/SQL code Bind and Substitution Variables, Printing in PL/ SQL.
3. Write a PL/SQL block using SQL and Control Structures in PL/SQL.
4. Write a PL/SQL code using Cursors, Exception and Composite Data Types.
5. Write a PL/SQL code using Procedures, Functions and Packages.

Note: The creation of sample database for the purpose of the experiments is expected to be pre-decided by the instructor.

Text Books / Suggested Reading:

1. "Oracle: The complete Reference", by Oracle Press.
2. Nilesh Shah, "Databse Systems Using Oracle", PHI, 2007.
3. Rick F Van der Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007.

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18CS C16

IT WORKSHOP (Latex / Scilab)

Instruction	1T + 2P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course Objectives: The objectives of this course are
1. Familiarize the students with documentation and visualization tools like Latex and Scilab.
2. Development of proficiency in documentation for presentation and report writing.
3. Explore the utilities in Latex and Scilab.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the need of documentation tools.
2. Install the documentation tools.
3. Generate templates for generation report using Latex.
4. Generate templates for presentation using Beamer.
5. Explore the utilities of Scilab

LIST OF EXPERIMENTS:
1. Installation of Latex and Scilab.
2. Understanding Latex compilation, basic syntax, writing of equations, matrices, tables.
3. Page Layout –Titles, abstract, chapters, sections, references, equation, references, citation, table of contents, generating new commands, figure handling, numbering, list of figures, list of tables, generating index.
4. Packages: Geometry, hyperref, amsmath, amssymb, algorithms, algorithmic graphic, color, tiles listing.
5. Understanding of Classes: article, book, reports,
6. Beamer, slides preparation.
7. Writing Resume, question paper, articles, research papers, Presentation using beamer.
8. Basic syntax, Mathematical Operators, Predefined constants, Built in functions.
9. Scilab Programming: Functions, loops, conditional statements, handling .sci files.
10. Graphics handling: 2D, 3D, Generating .jpg files, function plotting, data plotting.
11. Solving linear equations, Eigen values and numerical analysis, iterative methods, ordinary differential equation, plotting solution curves,
12. Comparison OS Scilab with C / C++/ Matlab.

Text Books / Suggested Reading / Online Resources:
1. https://www.latex-project.org/help/documentation/
2. https://spoken-tutorial.org/tutorial ef,search?search_foss=LaTeX& search_language=English
3. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
4. https://www.scilab.org/tutorials\

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AICTE-Model Curriculum

B.E Syllabus for Semester V and VI

With effect from 2020 - 21

Specialization /Branch: Computer Science and Engineering

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Chaitanya Bharathi (P.O), Gandipet

Hyderabad-500075, Telangana State.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

SCHEME OF INSTRUCTION AND EXAMINATION
V-Semester of B.E, Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-V

Sl.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18CSC17	Formal Language and Automata Theory	3	0	0	3	30	70	3
2	18CSC18	Operating System	3	0	0	3	30	70	3
3	18CSC19	Design and Analysis of Algorithms	3	0	0	3	30	70	3
4	18CSE XX	Professional Elective-I	3	0	0	3	30	70	3
5	18MTO XX	Open Elective-I	3	0	0	3	30	70	3
PRACTICALS									
6	18CSC20	Operating System Lab	0	0	3	3	25	50	1.5
7	18CSC21	Design and Analysis of Algorithms Lab	0	0	3	3	25	50	1.5
8	18CSE XX	Professional Elective-I Lab	0	0	3	3	25	50	1.5
9	18CSC22	Mini Project	0	0	3	-	50	-	1
		TOTAL	**15**	**0**	**12**		**275**	**500**	**20.5**

PROFESSIONAL ELECTIVE-I			OPEN ELECTIVE-I	
Course Code	**Title of the Course**		**Course Code**	**Title of the Course**
18CSE01	Web and Internet Technologies		18MTO 01	Decision Theory
18CSE02	GUI Programming		18MTO 02	Graph Theory
18CSE03	Image Processing		18MTO 03	Number Theory and Cryptography
18CSE04	Mobile Application Development		18MTO 04	Quantum Computing

PROFESSIONAL ELECTIVE-I LAB	
Course Code	**Title of the Course**
18CSE05	Web and Internet Technologies Lab
18CSE06	GUI Programming Lab
18CSE07	Image Processing Lab
18CSE08	Mobile Application Development Lab

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

18CSC17

FORMAL LANGUAGE AND AUTOMATA THEORY

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Discrete Mathematics, Data Structures, Algorithms.

Course Objectives: The objectives of this course are

1. Identify the hierarchy of formal languages, grammars and Design finite automata to accept a set of strings of a language.
2. Prove that a given language is regular and apply the closure properties of languages and design context free grammars, conversions into normal forms.
3. Equivalence of languages accepted by Push Down Automata and distinguish between computability and non-computability and Decidability and Undecidability.

Course Outcomes: On Successful completion of this course, student will be able to

1. Describe language basics like Alphabet, strings, grammars, productions, derivations, and Chomskyhierarchy.
2. Recognize regular expressions, formulate, and build equivalent finite automata for various languages.
3. Identify closure, decision properties of the languages and prove the membership.
4. Demonstrate context-free grammars, check the ambiguity of the grammars and design equivalent PDA to accept.
5. Use mathematical tools and abstract machine models to solve complex problems.
6. Distinguish between decidability and undecidability.

UNIT - I

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages**.** Regular languages and finite automata: Regular expressions and languages, Deterministic Finite Automata (DFA) and equivalence with regular expressions, Nondeterministic Finite Automata (NFA) and equivalence with DFA.

UNIT - II

Finite Automata and Regular Expression: From DFAs to Regular Expressions, Converting DFA's to Regular Expressions by Eliminating States, Converting Regular Expressions to Automata, Applications of Regular Expressions, and Algebraic Laws for Regular Expressions. **Properties of Regular Languages:** Proving Languages not to be Regular: The pumping lemma for Regular Languages, Applications of Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages: Testing Emptiness of Regular Languages, Testing Membership in a Regular Language. Equivalence and Minimization of Automata:

UNIT - III

Context-free Languages and Pushdown Automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, Closure properties of CFLs.

UNIT - IV

Context-sensitive Languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. **Turing Machines:** The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs.

UNIT - V

Unrestricted grammars and equivalence with Turing machines, TMs as enumerators. Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D Ullman, "Introduction to Automata Theory Languages and Computation", Third edition, Pearson Education, 2007.

Suggested Reading:

1. John C Martin. "Introduction to Language and Theory of Computation", 3rdedition, TMH, 2003.
2. Daniel Cohen, "Introduction to Computer Theory", 2ndedition, Wiley Publications, 2007.

3. Mishra K., Chandrasekaran N., “Theory of Computer Science (Automata, Languages and Computation)”, 3rd edition, Prentice Hall of India 2008.
4. Shyamalendra Kandar, “Introduction to Automata Theory, Formal Languages and Computation”, Pearson, 2013.
5. Kamala Krithivasan, Rama R. “Introduction to Automata Theory, and Computation”, Pearson 2009.

Web Resources:

1. http://courses.cs.vt.edu/cs4114/spring2012/index.php
2. www.pearsoned.co.in/KamalaKrithivasan

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18CSC18

OPERATING SYSTEMS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Programming for Problem Solving, Object Oriented Programming, Discrete Mathematics and Data Structure, Basic object-oriented design principles

Course Objectives: The objectives of this course are
1. Make the students to understand the basic components of a computer operating system, and interactionsamong the components
2. Cover an introduction on policies for scheduling, deadlocks, memory management, synchronization,system calls, and file systems.
3. Design operating system solutions

Course Outcomes: On Successful completion of the course, students will be able to
1. Define the fundamental components of a computer operating system and the interactions among them
2. Illustrate CPU scheduling algorithms, memory management techniques and deadlock handling methods
3. Build applications using semaphores and monitors to synchronize their operations
4. Analyse the performance of CPU scheduling and page replacement algorithms
5. Evaluate the structure of GNU/Linux and Android

UNIT - I

Introduction: Components of a computer operating systems, types of operating systems, operating system services, basic structure of Windows, Linux.

Processes & threads: Process states and transitions, Process Control Block (PCB), context switching, dispatcher. Threads, thread states, benefits of threads, types of threads

UNIT - II

Process Scheduling: Types of schedulers, Scheduling Criteria, scheduling algorithms, multiprocessor and real Time scheduling CPU scheduling in MS Windows

Memory Management: Memory management techniques, fragmentation, paging, segmentation, paged segmentation

UNIT - III

Inter-process Communication: Critical Section, race conditions, mutual exclusion, shared memory, message passing, semaphores and monitors, classical IPC Problems: producer-consumer, readers-writer and dinning philosopher

Deadlocks: conditions, deadlock handling methods, RAG, Banker’s algorithm, deadlock recovery.

UNIT - IV

Virtual Memory: Introduction, locality of reference, page fault, thrashing, working Set, demand paging, pagereplacement algorithms, allocation of frames.

File Management: File access methods, directory structure, file system structure, Allocation methods, directory implementation, efficiency, and performance.

Disk Management: Disk structure, scheduling, reliability, disk formatting, swap space management

UNIT - V

I/O: devices, controllers, types of I/O, device drivers, Kernel I/O Structure, performance, Streams

Linux System-Design principles, modules, Process management, scheduling, memory management, I/Omanagement, file System, inter-process communication.

Mobile OS: iOS and Android architecture and SDK framework, media layer, services layer, core OS layer, filesystem.

Textbooks:

1. AviSilberschatz, Peter Galvin, Greg Gagne, “ Operating System Concepts Essentials”, Wiley Asia Student Edition, 9th Edition, 2015
2. William Stallings, “Operating Systems: Internals and Design Principles”, Prentice Hall of India, 5th Edition, 2013.
3. Neil Smyth, iPhone iOS 4 Development Essentials Xcode, Fourth Edition, Payload media, 2011

Suggested Reading:

1. Charles Crowley, “Operating System: A Design-oriented Approach”, Irwin Publishing, 1st Edition, 1996.

Online Resources:

1. https://nptel.ac.in/courses/106108101/

18CSC19

DESIGN AND ANALYSIS OF ALGORITHMS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basics of Data structures and algorithms.

Course Objectives: The objectives of this course are
1. Provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms.
2. Introduce the different algorithmic approaches for problem solving through numerous example problems.
3. Provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness.

Course Outcomes: On Successful completion of this course, student will be able to
1. List the performance metrics and design strategies of algorithms.
2. Describe the algorithmic design techniques of divide and conquer, greedy, dynamic programming,backtracking and branch and bound to solve problems.
3. Apply suitable algorithmic design techniques to solve problems.
4. Analyze the performance of a given algorithm.
5. Evaluate various algorithmic design techniques.
6. Formulate solutions to NP problem.

UNIT - I

Introduction: Characteristics of algorithm. **Analysis of algorithm:** Asymptotic analysis of complexity bounds – best, average and worst-case behavior. Performance measurements of Algorithm, Time and space trade-offs. **Analysis of recursive algorithms through recurrence relations:** Substitution method, Recursion tree method and Masters' theorem.

UNIT - II

Greedy Algorithms: The general method, Knapsack Problem, Huffman Codes, Job scheduling with deadlines. **Dynamic Programming**: The general method, 0/1 Knapsack, Travelling Salesman Problem, Matrix chain multiplication, Longest Common subsequence, Optimal Binary search tree.

UNIT - III

Backtracking: The general Method, 8-Queens Problem, Graph Coloring, Hamiltonian Cycle. **Branch-and-Bound**: The general method, FIFO branch and bound, LC branch and bound, 0/1 Knapsack Problem, Travelling Salesperson problem.

UNIT - IV

Graph Algorithms: Applications of DFS: Bi-Connected components, strongly connected components, topological sorting. **Shortest Path Algorithms**: Dijkstra's, Bellman-Ford, Floyd-Warshall and Johnson's algorithms. **Minimum Spanning Tree Algorithms**: Prim's and Kruskal's.

UNIT - V

Theory of NP-Completeness: Polynomial time, Polynomial time verification, P, NP, NP-hard and NP-Complete classes, NP-Completeness and Reducibility. **Standard NP-Complete Problems and Reduction Techniques:** The Clique Problem, vertex-cover and Subset Sum Problem.

Text Books:
1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press/McGraw-Hill, 3rd Edition, 2009.
2. E. Horowitz, sartaj sahni and sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press, 2007.

Suggested Reading:
1. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis", and Internet Examples, Wiley Second Edition.

Online Resources:
1. https://nptel.ac.in/courses/106101060/

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18CSE01

WEB AND INTERNET TECHNOLOGIES
(PROFESSIONAL ELECTIVE-I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Programming and Problem Solving, Object Oriented Programming, DBMS.

Course Objectives: The objectives of this course are
1. Acquire knowledge of XHTML, Java Script and XML to develop web applications.
2. Develop dynamic web content using Java Servlets and JSP and JDBC.
3. Develop to complete web applications.

Course Outcomes: On Successful completion of the course, students will be able to
1. Develop static web sites using XHTML and Java Scripts.
2. Understand the role of XML and Java Script in web applications.
3. Write programs in java using all of its object oriented concepts.
4. Differentiate between Servlets and JSPs and use them according to the demands of the situation in developing dynamic web content.
5. Use JDBC to access a remote database in a web application.

UNIT - I

Web Basics and Overview: Introduction to Internet, World Wide Web, URL, MIME, HTTP. Introduction and basics of XHTML, Cascading Style Sheets, Introduction to XML, XML document structure, DTD, Namespacesand Schemas.

UNIT - II

The Basics of Java script: General Syntactic Characteristics, Primitive operations and Expressions, Arrays, Functions, Pattern Matching Using Regular Expressions, Document Object Model, Element Access in JavaScript, Events and Event Handling, Handling Events from Body, Button, Text Box and Password Elements. **Dynamic Documents with Java Script:** Positioning Elements, Moving Elements, Changing Colors and Fonts, Dynamic Content.

UNIT - III

The Java Language: Basics an overview of Java, The General Form of a class, Declaring Objects, Constructors, Overloading Methods, Overloading Constructors, static and final keywords, Inheritance Basics, Using Super, Using Abstract classes, Packages and Interfaces, dynamic method dispatch and Exception Handling.

UNIT - IV

J2EE Platform: Enterprise Architecture Styles, Containers and Technologies. **Servlet Programming**: Overview of Java Servlet API, Servlet Implementation, Servlet Configuration, Servlet Exceptions, Servlet Life cycle, Request and Responses. **Servlet Sessions, Context and Collaboration**: Approaches to Session tracking, Session Tracking with java servlet API, Servlet Context, Servlet Collaboration. **Filters for web applications**: Introduction to filters, filter API, Deployment descriptor for filters.

UNIT - V

JSP Basics: Introduction to JSP, Directives, Scripting Elements, Standard Objects, Design Strategies. **JSP Tag extensions**: Tag extensions, A simple Tag Anatomy of a Tag extension, Writing Tag Extensions. **Java Database Connection**: Introduction to JDBC, Database Drivers. Database Access with JDBC using servlet and jsp**:** Connection to a remote data base, CRUD operations, Callable Statement and Prepared Statement. ResultSet and RowSet objects.

Textbooks:

1. Robert W Sebesta, "Programming the World Wide Web", Pearson Education, 2013
2. CeditBuest, Subramanyam Allamraju, "Professional Java Server programming: J2EE 1.3 Edition", Apress Publications, 2007.

Suggested Reading:

1. Santosh Kumar K., "JDBC 4.2. Servlet 3.1 and JSP 2.3 Includes JSF 2.2 and Design Patterns", 2nd edition, 2016
2. 2. P. J. Deitel Deitel, H. M. Deitel – Deitel, "Internet & World Wide Web How To Program", Fourth Edition, Prentice Hall, 2007.
3. Chris Bates, "Web Programming, building intenet applications", 2nd edition, John Wiley & Sons, 2002

Online Resources:

1. https://www.w3.org/standards/webdesign/
2. https://www.w3schools.com/
3. https://devdocs.io/

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18CSE02

GUI PROGRAMMING (PROFESSIONAL ELECTIVE-I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Basics of Python Programming.

Course Objectives: The objectives of this course are
1. Understand the essence of GUI programming.
2. Identify various GUI frameworks.
3. Develop GUI based applications using GUI tools/frameworks.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand GUI frameworks / tool required for GUI programming.
2. Explore the features of PyQt for the develop GUI applications.
3. Customize GUIs by using layout managers and look-and-feel features.
4. Develop beautiful charts using the free Matplotlib Python module.
5. Design and develop UIs using threading in a networked environment to make the GUIs responsive andcompatible with Android, iOS.

UNIT - I
Introduction to GUI Programming: UI and interaction design, examples, components of GUI, comparison to other interfaces, 3-D user interfaces, and other GUI frameworks. **Introduction to PyQt5 Framework:** Overview, installation of PyQt framework, creation of a simple GUI, adding widgets to GUI, layout of widgets.

UNIT - II
Design of GUIs with Qt Designer: Installation of Qt Designer and tools, creation of a GUI, adding widgets, conversion of Qt Designer UI code to Python code.

UNIT - III
Enhancing Qt5 GUI functionality: Calling Dialogs from main window, decoupling Python code from generated UI code, building a complex GUI with PyQt5, Multi-threading to keep GUI responsive, Drag and Drop within the PyQt5 GUI.

UNIT - IV
Advanced Qt5 Programming: OpenGL Graphics library, networking and SQL database, Animation inside the GUI, CSS styling to enhancement for look-and- feel, PyQt's signals and slots, event handling.

UNIT - V
User Interface Design: Design of uesr interfaces, displaying Google and Qt5 Maps, creation of iPhone and Android Apps with Qt5. **Creation of 3D GUI with PyOpenGL and Pyglet**: PyOpenGL transforms for GUI, GUI in 3D, Pyglet transform for easy GUI, creation of slideshow using tkinter, best practices.

Text Books:
1. Burkhard A. Meier "Python GUI Programming Recipes using PyQt5", Packt, 2017.
2. Burkhard A. Meier, "Hands-on Python 3.x GUI Programming: Pack 2019.

Online Resources:
1. https://en.wikipedia.org/wiki/Graphical_user_interface#Technologies.

18CSE03

IMAGE PROCESSING
(PROFESSIONAL ELECTIVE-I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Analysis of algorithms and linear algebra.

Course Objectives: The objectives of this course are
1. Gain the fundamentals of digital image processing.
2. Comprehend the relation between human visual system and machine perception and processing ofdigital images.
3. Provide a detailed approach towards image processing applications like enhancement, segmentation,and compression.

Course Outcomes: On Successful completion of this course, student will be able to
1. Explain the basic principles of image processing and its significance in real world.
2. Interpret various types of images and applies image transformations.
3. Evaluate various approaches for image segmentation and image restoration.
4. Define image processing methods and recognize morphological image processing techniques.
5. Recognize image compression and comprehend image compression techniques in both domains.
6. Apply image processing algorithms for real world problems.

UNIT - I

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels. **Image Transforms:** 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

UNIT - II

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering. **Image Enhancement (Frequency Domain):** Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

UNIT - III

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.
Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, thresholding, Region Oriented Segmentation.

UNIT - IV

Morphological Image Processing: Basics, Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation. Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Geodesic Dilation, Erosion, Reconstruction by dilation and erosion.

UNIT - V

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Pearson 4th Edition, 2018.
2. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image Processing”, McGraw Hill Education, 2010.

Suggested Reading:

1. Scotte Umbaugh, “Digital Image Processing and Analysis: Human and Computer Vision Application with using CVIP Tools”, CRC Press,2nd Ed, 2011.
2. Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, “Digital Image Processing using MATLAB”, McGraw Hill Education, 2nd Edition, 2010.
3. Somka, Hlavac, Boyle, “Digital Image Processing and Computer Vision”, Cengage Learning (Indian edition) 2008.
4. Adrian Andrew Low, “Introductory Computer Vision Imaging Techniques and Solutions”, BS Pub, Second Edition, 2008.

Online Resources:

1. https://nptel.ac.in/courses/117105079/
2. www.nptelvideos.in/2012/12/digital-image-processing-html

18CSE04

MOBILE APPLICATION DEVELOPMENT
(PROFESSIONAL ELECTIVE-I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Programming language skills, Problem solving skills, Applying technologies.

Course Objectives: The objectives of this course are
1. To demonstrate their understanding of the fundamentals of Android operating systems.
2. To demonstrate their skills of using Android software development tools.
3. To demonstrate their ability to develop software with reasonable complexity on mobile platform.

Course Outcomes: On Successful completion of the course, students will be able to
1. Interpret and Analyze Android platform architecture and features to learn best practices in Androidprogramming.
2. Design the User Interface for Mobile applications.
3. Apply Intents, Broadcast receivers and Internet services in Android App.
4. Develop database management system to retrieve and/or store data for Mobile application.
5. Evaluate and select appropriate Android solutions to the Mobile computing platform.
6. Build Android applications for complex problems.

UNIT - I
Introduction to Android Operating System: Android SDK Features, Developing for Android, Best practices in Android programming, Android Development Tools. Android application components – Android Manifest file, Externalizing resources, The Android Application Lifecycle, A Closer Look at Android Activities.

UNIT - II
Android User Interface: Introducing Layouts, User Interface (UI) Components – Editable and non editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers. Event Handling – Handling clicks or changes of various UI components. Introducing Fragments, Multi-screen Activities.

UNIT - III
Intents and Broadcasts: Introducing Intents: Using Intents to Launch Activities. Using Intent to dial a number or to send SMS. **Broadcast Receivers** –Creating Intent Filters and Broadcast Receivers: Using Intent Filters to Service Implicit Intents. Finding and using Intents received within an Activity. Notifications – Creating and Displaying notifications, Displaying Toasts.

UNIT - IV
Persistent Storage: Files – Reading data from files, listing contents of a directory, Creating and Saving Shared Preferences, Retrieving Shared Preferences. Database –Introducing Android Databases, Introducing SQLite, Content Values and Cursors, Working with SQLite Databases. Registering Content Providers, Using content Providers (insert, delete, retrieve and update).

UNIT - V
Advanced Topics: Alarms –Using Alarms. Using Internet Resources – Connecting to internet resource, using download manager. Location Based Services –Using Location-Based Services, Using the Emulator with Location-Based Services.

Text Books:
1. Reto Meier, "Professional Android 4 Application Development", Wiley India, (Wrox), 2012
2. James C Sheusi, "Android Application Development for Java Programmers", Cengage Learning, 2013

Suggested Reading:
1. Wei-Meng Lee, "Beginning Android 4 Application Development", Wiley India (Wrox), 2013

18MTO 05

DECISION THEORY(OPEN ELECTIVE-I)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The objectives of this course are
1. Identifying and develop Operations Research Models from the verbal description of real system.
2. Able to learn different techniques to get optimum solution LPP.
3. Able to understand the Mathematical tools that are needed to solve optimization problem.
4. Able to analyze the results of the different real-world problems.
5. Able to formulate the problems and solve situation using dynamic programming problem technique.

Course Outcomes: On the successful completion of this course, the student shall be able to
1. Calculate the optimum values for given objective function by LPP
2. Solve the solution for maximise the profit with minimum cost by Transportation problem.
3. Determine the optimum feasible solution for sequencing the Jobs
4. Arrange the jobs for different Machines to get optimum values
5. Measure the solution of dynamical system problems

UNIT-I
Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research, Linear Programming Problem-Formulation of LPP, Graphical solution of LPP, Simplex Method, Artificial variables, big-M method.

UNIT-II
Transportation problems, Formulation, solution, unbalanced transportation problems, finding basic feasible solutions- North-west corner rule, least cost method and Vogel's approximations method, Optimality test: the steppingstone method and MODI method.

UNIT-III
Assignment model, formulation, Hungarian method for optimal solution, solving unbalanced problem, Travelingsalesman problem and assignment problem

UNIT IV
Sequencing models, solution of sequencing problem-processing n jobs through 2 Machines-processing n jobs through 3 Machines-processing 2 jobs through m machines-processing n jobs through m machines.

U
NIT-V
Dynamic Programming, Characteristics of dynamic programming, Solution of LPP by dynamic programming and Network scheduling by PET/CPM.

Textbooks:
1. P. SankaraIyer, "Operations Research", Tata McGraw-Hill, 2008.
2. A.M. Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Educairons, 2005.

Suggested Reading:
1. J K Sharma, "Operations Research Theory & Applications, 3e", Macmillan India Ltd, 2007.
2. P.K.Gupta and D.S.Hira, "Operations Research", S.Chand& Co, 2007.
3. Kranti Swarup ,P.K.Gupta and Man Mohan "Operations Research", Sultan Chand & Sons, 2019.

Professor and Head Department

18MTO 02

GRAPH THEORY
(OPEN ELECTIVE-I)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The objectives of this course are
1. To discuss the basic and core concepts in Graph, Euler Graph and its path.
2. To explain the Matching and Covering in Bipartite Graph.
3. To demonstrate how Matching are used in Principles, Models underlying theory.
4. To explain One-Way Traffic, Rankings in a tournament.
5. To discuss Algorithmic approach to solve Network flow problems.

Course Outcomes: On Successful completion of this course, student will be able to
1. Identify the concepts of the Graph Theory in related problems.
2. Determine the solutions in Matching and Covers, Maximum Matching in Bipartite Graph.
3. Calculate the solutions for Matching and Faster Bipartite Matching, Matching in general graphs andrelated Algorithms.
4. Apply the Knowledge of Job sequencing, One-Way Traffic, Rankings to solve real time problems.
5. Solve combinatorial optimization problems pertaining to Network flow.
6. Construct solutions to real world problems.

UNIT – I

Introduction to Graphs and its Applications: Basics of Paths, Cycles, and Trails, Connection, Bipartite Graphs, Eulerian Circuits, Vertex Degrees and Counting, Degree-sum formula, The Chinese –Postman- Problem and Graphic Sequences.

UNIT – II

Matchings: Matchings and Covers, Hall's Condition, Min-Max Theorem, Independent Sets, Covers and Maximum Bipartite Matching, Augmenting Path Algorithm.

UNIT – III

Matchings and its Applications: Weighted Bipartite Matching, Hungarian Algorithm, Stable Matchings and Faster Bipartite Matching, Factors & Perfect Matching in General Graphs, Matching in General Graphs: Edmonds' Blossom Algorithm.

UNIT – IV

Directed graphs and its Applications: Directed Graphs, Directed Paths, Directed Cycles, Applications - A Job Sequencing Problem, Designing an Efficient Computer Drum, Making a Road System One-way, Ranking the Participants in a Tournament.

UNIT – V

Networks and its Applications: Flows, cuts, Ford-Fulkerson labelling algorithm, the max-flow min-cut theorem, Applications-Menger's theorems, Feasible flows.

Text Books:
1. J.A. Bondy and U.S.R.Murty, "Graph Theory with Applications", Springer, 2008 (Freely downloadable from Bondy's website).
2. D.B.West, "Introduction to Graph Theory", Prentice-Hall of India/Pearson, 2009 (latest impression).
3. N. Deo, "Graph Theory with Applications to Engineering and Computer Science", PHI Publication, 3rd edition, 2009.

Suggested Reading:
1. R.Diestel, "Graph Theory", Springer (low price edition) 2000.
2. F.Harary, "Graph Theory", Narosa, print 2013.
3. C.L. Liu, "Elements of Discrete Mathematics", Tata McGraw Hill, 2nd Edition, 2000.

18MTO 03

NUMBER THEORY AND CRYPTOGRAPHY
(OPEN ELECTIVE-I)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The objectives of this course are
1. To introduce impart the knowledge of cryptography before computer age.
2. To introduce discrete logarithmic problem.
3. To introduce some primality tests.
4. To introduce RSA cryptography.
5. To get on exposure to elliptic curve cryptography.

Course Outcomes: On Successful completion of this course, student will be able to
1. Count different operations of basic number theory.
2. Distinguish between public Key and related algorithms.
3. Define algebraic theorems with respect to well-known algorithms.
4. Apply the Euler's φ function and related algorithms in RSA crypto system.
5. Appraise security issues on elliptic curve cryptography.

UNIT – I

Simple substitution ciphers, Divisibility and greatest common divisors, Modular arithmetic, Prime numbers, unique factorisation, and finite fields, Powers and primitive roots in finite fields, Cryptography before the computer age Symmetric and asymmetric ciphers.

UNIT – II

The birth of public key cryptography, The discrete logarithm problem, Diffie–Hellman key exchange, The ElGamal public key cryptosystem, An overview of the theory of groups, How hard is the discrete logarithm problem? A collision algorithm for the DLP.

UNIT – III

The Chinese remainder theorem, The Pohlig–Hellman algorithm, Rings, quotients, polynomials, and finite fields, Euler's formula and roots modulo pq, Primality testing.

UNIT – IV

The RSA public key cryptosystem ,Implementation and security issues, Pollard's p−1 factorisation algorithm, Factorisation via difference of squares, Smooth numbers and sieves.

UNIT – V

Elliptic curves, Elliptic curves over finite fields, The elliptic curve discrete logarithm problem, Elliptic curve cryptography.

Textbooks:

1. Mathematical Cryptography by JefreyHostein, Jill Pipher, Joseph H. Silverman Springer Science+ Business Media, LLC.
2. G.A. Jones & J.M. Jones, "Elementary Number Theory", Springer UTM, 2007.

Suggested Reading:

1. Keith Martin, "Everyday Cryptography: Fundamental Principles and Applications"
2. N. P. Smart, "Cryptography: An Introduction" 3rd edition, Springer,2016.

18MTO 04

QUANTUM COMPUTING
(OPEN ELECTIVE-I)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The objectives of this course are
1. To translate fluently between the major mathematical representations and its quantum operations.
2. To implement basic quantum algorithms.
3. To explain quantum decoherence in systems for computation.
4. To discuss the physical basis of uniquely quantum phenomena.

Course Outcomes: On Successful completion of this course, student will be able to
1. Identify the working of a Quantum Computing Program, its architecture and program model.
2. Compute basic mathematical operations.
3. Demonstrate quantum logic gate circuits.
4. Develop quantum algorithm.
5. Appraise quantum algorithm on major toolkits.

UNIT – I

Introduction to Quantum Computing: Motivation for Studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc), Origin of Quantum Computing, Overview of major concepts in Quantum Commuting (Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement).

UNIT – II

Math Foundation for Quantum Computing: Matrix Algebra: Basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen Vectors.

UNIT – III

Building Blocks for Quantum Program: Architecture of a Quantum Computing Platform, Details of q-bit system of information representation (Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from Quantum algorithmic perceptive e.g. Bell State.

UNIT – IV

Quantum Logic gates and Circuits: Quantum Logic gates and Circuit:Pauli, Hadamard, Phase shift, controlled gates, ising, Deutsch, Swap etc.), Programming model for a Quantum Computing program (Steps performed on classical computer, steps performed on Quantum Computer, Moving data between bits and qubits).

UNIT – V

Quantum Algorithms: Basic techniques exploited by quantum algorithms (Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum walks), Major Algorithms (Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm), OSS Toolkits for implementing Quantum program (IBM quantum experience, Microsoft Q, Rigetti PyQuil (QPU/QVM)).

Textbooks:
1. Michael A.Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley

Suggested Reading:
1. Jack D. HidaryQuantum Computing - An Applied Approach (Springer) 2019

18CSC20

OPERATING SYSTEMS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Course Objectives: The objectives of this course are
1. Familiarize the students with GNU/Linux environment
2. To design and apply the process management concepts.
3. To design and apply the storage management concepts.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Able to use and develop shell scripts for process management
2. Demonstrate CPU scheduling and page replacement algorithms
3. Demonstrate GNU/Linux interprocess communication mechanisms and deadlock detection using Banker's algorithm
4. Evaluate CPU scheduling and page replacement algorithms
5. Design and create system calls

LIST OF EXPERIMENTS
1. Explore basic GNU/Linux utilities and vim/gvim editor features
2. Demonstration of process management system calls
3. Demonstration of thread related system calls
4. Demonstration of CPU scheduling algorithms
5. Performance evaluation of CPU scheduling algorithms
6. Demonstration of GNU/Linux IPC mechanisms- semaphores, shared memory, message passing
7. Evaluation of page replacement algorithms
8. Implementation of producer-consumer, readers- writers and dining philosopher's problem using semaphores
9. System call implementation

Textbooks:
1. K A Robbin and Steve Robbins "UNIX Systems Programming", PHI, 2003.
2. Deitel and Deitel, "Operating System", Pearson Education, New Delhi, Third Edition, 2007.

Online Resources:
1. https://www.kernel.org/
2. https://www.kernel.org/doc/html/v4.10/process/adding-syscalls.html

Professor and Head Department

18CSC21

DESIGN AND ANALYSIS OF ALGORITHMS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: PPS, Basics of Data structures and algorithms lab and OOP.

Course Objectives: The objectives of this course are
1. Design and construct simple programs by using the different design strategies for solving different problems.
2. To enhance programming skills while improving their practical knowledge in implementing the algorithms.
3. To strengthen the practical ability and to apply suitable algorithmic approaches for solving real time problems.

Course Outcomes: On Successful completion of this course, student will be able to
1. Identify and setup environment for the implementation of algorithms.
2. Implement divide and conquer, greedy, dynamic programming, backtracking and branch and boundtechniques.
3. Demonstrate various algorithmic design techniques.
4. Analyze the performance of various algorithms.
5. Compare various design strategies.
6. Formulate solutions to solve real world problems use acquired knowledge.

The following task should be carried out by the students in the laboratory for each experiment:-
1. Setup the environment for the experiment.
2. Select appropriate design technique to implement the problem.
3. Represent the solution using algorithm
4. Analyze the performance of the algorithm (Time and Space complexity)
5. Justify the performance of your solution is better than other strategies.

By performing the above task for each experiment the following COs are achieved,

Course Outcome	1	2	3	4	5	6
Task	1	2	3	4	5	*

*As all the questions are real world applications so CO6 is achieved

List of Experiments:

1. You are given the task of choosing the optimal path to connect ‘N’ devices. The devices are connected with the minimum required N-1 wires into a tree structure, and each device is connected with the other with a wire of length ‘L’ ie ‘D1’connected to ‘D2’ with a wire of length ‘L1’. This information will be available for all ‘N’ devices.
   a) Determine the minimum length of the wire which consists of N-1 wires that will connect all devices.
   b) Determine the minimum length of the wire which connects Di and Dj
   c) Determine the minimum length of the wire which connects Di to all other devices.
   d) Determine the minimum length of the wire which connects Di to all other devices where $1 \leq i \leq N$.
2. An X-ray telescope (XRT) is a telescope that is designed to observe remote objects in the X-ray spectrum. In order to get above the Earth's atmosphere, which is opaque to X-rays, X-ray telescopes must be mounted on high altitude rockets, balloons or artificial satellites. Planets, stars and galaxies and the observations are to be made with telescope. Here the process of rotating equipment into position to observe the objects is called slewing. Slewing is a complicated and time consuming procedure handled by computer driven motors. The problem is to find the tour of the telescope that moves from one object to other by observing each object exactly once with a minimum total slewing time.
3. CSE department of CBIT want to generate a time table for ‘N’ subjects. The following information is given- subject name, subject code and list of subjects code which clashes with this subject. The problem is to identify the list of subjects which can be scheduled on the same time line such that clashes among them do not exist.
4. A Test has ‘N’ questions with a heterogeneous distribution of points. The test-taker has a choice as to which questions can be answered. Each question Qi has points Pi and time Tito answer the question, where $1 \leq i \leq N$. The students are asked to answer the possible subsets of problems whose total point values add up to a maximum score within the time limit ‘T’. Determine which subset of questions gives student the highest possible score.
5. Given N items with their corresponding weights and values, and a package of capacity C, choose eitherthe entire item or fractional part of the item among these N unique items to fill the package such that the package has maximum value.
6. Given a bunch of projects, where every project has a deadline and associated profit if the project is finished

before the deadline. It is also given that every project takes one month duration, so the minimum possible deadline for any project is 1 month. In what way the total profits can be maximized if only one project can be scheduled at a time.

7. N-Queen is the problem of placing ‘N’ chess queens on an N×N chessboard. Design a solution for this problem so that no two queens attack each other.
   Note: A queen can attack when an opponent is on the same row, column or diagonal.
8. Bi-connected graphs are used in the design of power grid networks. Consider the nodes as cities and the edges as electrical connections between them, you would like the network to be robust and a failure at one city should not result in a loss of power in other cities.
9. Consider a source code structure where you are building several libraries DLLs (Dynamic- Link Library) and they have dependencies on each other. For example, to build DLL , you must have built DLLs B, C and D (Maybe you have a reference of B,C and D in the project that builds A).

Textbooks:

1. Thomas H Cormen, Charles E Lieserso, Ronald L Rivesr and Clifford Stein, “Introduction to algorithms”, 3rd Edition, MIT Press/McGraw-Hill, 2009
2. Michel T Goodrich and Roberto Tamassia, “Algorithm Design: Foundations, Analysis and Internet Examples”. Second Edition, Wiley, 2001.

18CSE05

WEB AND INTERNET TECHNOLOGIES LAB
(PROFESSIONAL ELECTIVE-I LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Programming and Problem Solving, Object Oriented Programming, DBMS.

Course Objectives: The objectives of this course are
1. To acquire knowledge of XHTML, Java Script and XML to develop web applications.
2. Ability to develop dynamic web content using Java Servlets, JSP and JDBC.
3. To understand the design and development process of a complete web application.

Course Outcomes: On Successful completion of this course, student will be able to
1. Students will be able to develop static web sites using XHTML and CSS
2. Validate form data and create dynamic content using javascript
3. Develop Dynamic web content using Java Servlets and JSP
4. Handle Sessions and use servlet filters in web applications.
5. Validate form data and create dynamic content using javascript

LIST OF PROGRAMS
1. Design simple web pages using XHTML and CSS.
2. Categorize the content of web page using XML and validate using DTD and XML schema.
3. Create well structured, easily maintained web pages using CSS and Java script.
4. Examine dynamic web pages using Java script.
5. Design a dynamic webpage that meets specified requirements and interests of end users.
6. Apply the concepts of Inheritance and interfaces to solve complex problems.
7. Analyse and apply the concepts of Exception handling and packages.
8. Handling HTTP Sessions in web applications.
9. Demonstrate Servlet Collaboration using Servlet Context.
10. Creation of dynamic content in web application using JSP.
11. Provide a program level interface for communicating with database using JDBC.

Text Books:
1. Robert W Sebesta, "Programming the World Wide Web", Pearson Education, 2013
2. Cedit Buest, Subramanyam Allamraju, "Professional Java Server programming: J2EE 1.3 Edition", Apress Publications, 2007.

Suggested Reading:
1. Santosh Kumar K, "JDBC 4.2, Servlet 3.1 and JSP 2.3 Includes JSF 2.2 and Design Patterns", 2nd edition, 2016.

Online Resources:
1. https://www.w3schools.com/
2. https://www.tutorialspoint.com/servlets/index.htm.
3. https://www.oracle.com/technical-resources/articles/javase/servlets-jsp.html

Professor and Head Department

18CSE06

GUI PROGRAMMING LAB
(PROFESSIONAL ELECTIVE-I LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Basics of Python Programming.

Course Objectives: The main objectives of this course are
1. To familiarize the students with GUI development tools/frame works.
2. To Explore the features of PyQt and GUI Module.
3. To prepare the students developing GUI Applications.

Course Outcomes: On Successful completion of this course, student will be able to
1. Install and explore the features of selected IDE and frameworks.
2. Create widgets, buttons, tools and customize them using layout management tools.
3. Design user interfaces for the selected problem.
4. Implement the designed UI using PyQt and Dt Designer.
5. Customize UIs by using threading and make them responsive that are compatible with Android and iOS.

LIST OF PROGRAMS
1. Identification and installation of required software and tools.
2. Exploration of the installed IDEfor the development of GUI based applications
3. Demonstration of various buttons and tools.
4. Layout management of Widgets, buttons usngPyQt layout management tools.
5. Applying multithreading to make the GUI responsive.
6. Installation and exploration of Qt Designer.
7. Understanding and I/O requirements gathering for the selected problem.
8. Design of UI for the selected problem.
9. Implementation of the selected problem.
10. Enhancement of UI with CSS, event handling.
11. Applying 3D transformations using PyOpenGL.
12. Creation of slideshow using Tkinter.

Sample problems: Student marks management, Leave management, Attendance management, bank management, Student gate pass system, library management system, salary management system, canteen billing system, Bus ticket reservation system, Flight reservation system etc

Text Books:
1. Burkhard A. Meier "Python GUI Programming Recipes using PyQt5", Packt, 2017
2. Burkhard A. Meier, "Hands-on Python 3.x GUI Programming: Pack 2019

Online Resources:
1. https://www.tutorialspoint.com/python/python_gui_programming.htm
2. https://www.geeksforgeeks.org/python-gui-tkinter/

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18CSE07

IMAGE PROCESSING LAB
(PROFESSIONAL ELECTIVE-I LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Basics of programming language.

Course Objectives: The objectives of this course are
1. To impart knowledge about the fundaments concepts of digital image processing.
2. To study various image transformation and enhancement techniques used in digital image processing.
3. To discuss about the image reformation, segmentation techniques used in digital image processing.

Course Outcomes: On Successful completion of this course, student will be able to
1. Identify the fundamental issues and challenges of image processing.
2. Translate images from spatial to frequency domain by applying various transformations.
3. Perform point operations and filtering in both domains.
4. Apply various techniques to enhance and analyze the image in detail.
5. Interpret various compression techniques and edge detection methods.
6. Evaluate Image processing algorithms for real-world problems.

LIST OF THE EXPERIMENTS:
1. Implement Point processing on images in spatial domain.
    a. Negation of an image.
    b. Thresholding of an image.
    c. Contrast Stretching of an image.
2. Implement Bit Plane Slicing on images.
3. Implement Histogram Equalization on images.
4. Implement Histogram Specification on images.
5. Implement Zooming by interpolation and replication on images.
6. Implement Filtering in spatial domain
    a. Low Pass Filtering
    b. High Pass Filtering
    c. Median filtering.
7. Implement Edge Detection using derivative filter mask
    a. Prewitt
    b. Sobel
    c. Laplacian
8. Implement Data compression using Huffman coding
9. Implement filtering in frequency domain
    a. Low pass filter
    b. High pass filter
10. Implement Hadamard transformation.

Text Books:
1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, 4th Edition, Pearson, 2018
2. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image Processing”, - Mc Graw Hill Education, 2010.

Suggested Readings:
1. Scotte Umbaugh, “Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools”, 2nd Ed, CRC Press, 2011
2. Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, “Digital Image Processing using MATLAB”, 2nd Edition, Mc Graw Hill Education, 2010.

18CSE08

MOBILE APPLICATION DEVELOPMENT LAB
(PROFESSIONAL ELECTIVE-I LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Programming language skills, Problem solving skills.

Course Objectives: The objectives of this course are
1. To learn how to develop Applications in android environment.
2. To learn how to develop user interface applications.
3. To learn how to develop URL related applications.

Course Outcomes: On Successful completion of this course, student will be able to
1. Analyze all the components and their properties of various Emulators to select appropriate Emulator for Android App.
2. Apply essential Android programming concepts for developing efficient Mobile App.
3. Develop Android applications related to various Layouts.
4. Design applications with rich User interactive Interfaces.
5. Develop Android applications related to Mobile related server -less database like SQLite.
6. Extend Event Handling to develop various Mobile applications.

The student is expected to be able to do the following problems, though not limited.
1. Create an Android application that shows Hello + name of the user and run it on an emulator. (b) Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.
2. Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button. Use (a) Linear Layout, (b) Relative Layout and (c) Grid Layout or Table Layout.
3. Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a "Back" button. If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on right fragment instead of second screen with back button. Use Fragment transactions and Rotation event listener.
4. Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.
5. Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.
6. Create an application that uses a text file to store user names and passwords (tab separated fields and one record per line). When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with Login Failed message.
7. Create a user registration application that stores the user details in a database table.
8. Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially. Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user.

Tools:
1. Geny Motion Emulator.
2. Android Application Development with MIT App Inventor: For the first one week, the student is advised to go through the App Inventor from MIT which gives insight into the various properties of each component. The student should pay attention to the properties of each component, which are used later in Android programming.

Following are useful links:
1. http://ai2.appinventor.mit.edu
2. https://drive.google.com/file/d/0B8rTtW_91YclTWF4czdBMEpZcWs/view

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18CSC22

MINI PROJECT

Instruction	3Hours per week
CIE	50 Marks
Credits	1

Objective: The main objective of this mini project is to explore and strengthen the understanding of fundamentals through practical application of theoretical concepts. It enables the students to design and develop solutions to real world problems by applying programming knowledge to become a good engineer. It acts like a beginners guide to do larger projects later in their career.

Course Outcomes: At the end of the course, students will be able to

1. Identify and understand the real world problems.
2. Formulate the solutions to the problems by applying Computer Science and Mathematical fundamentals.
3. Represent the solutions by using various design aids/charts/diagrams.
4. Implement the solutions using modern tools/languages.
5. Analyze and interpret the experimentation results, draw conclusions
6. Communicate effectively through technical reports and presentation according to the documentation/report guidelines

Some of the guidelines for Mini Project:

1. **Selection of Topic**: Selection of topic is a huge and important task in a Mini Project. One should have a clear idea about one's subject strengths and the selected topic should be relevant to it. Always select the project that has value addition. As a graduate you should select a project which is either advantageous to a lot of people or enhance your technical and managerial skills. Your project must play its role towards a positive growth/development in that specific field.
2. **Research about the selected topic online:** Do some online research about the selected topic. Go through the research papers from different researchers around the world on the topics related to Mini Project. Find some websites containing the information about the materials used for Mini Project.
3. **Suggestions from subject experts:** Go to the subject experts in your department and interact with them about the Mini Project topic. You can also meet many subject experts from other department or various parts of the society through physically or social media and some discussion forums. This helps you in getting suggestions in different possible ways, through which you can get a clear idea on your Mini Project topic.
4. **Planning:** After getting a clear idea about the topic, prepare a rough plan about procurement of resources, experimentation and fabrication along with your teammates. Make a rough schedule, adapt to it and distribute the work among your teammates. This will keep your Mini Project on track and individuals will come to know about their part in the Mini Project rather than any individual (leader) taking full responsibilities.
5. **Execution of plans:** Make sure that the materials will be ready for the experimentation/fabrication by the scheduled time. Follow the schedule during experimentation/fabrication to get accurate and efficient results.
6. **Presentation:** Experimentation/Fabrication does not make a Mini Project successful; one should be able to present the results in proper way. So it should be prepared in such a way that, it reflects the exact objective of your Mini Project.

Guide lines / Instructions:

1. Each Mini project must be done in a group of 2-3 students.
2. Choose the topic/problem related to the fields/courses studied earlier or current semester
3. Each group must prepare a title of the mini project that relates to any engineering discipline and the title must emulate any real-world situation / problem.
4. Submit an early proposal (1-2 pages report describing what is the project about and the outcome of the final product would be, by the end of **Fourth Week**.
5. The title must be submitted to the respective lecturer by the end of week 9
6. Report must be submitted during the project presentation (**14th Week**)
7. Students are required to carry out the mini project in any one of the areas/courses that they have studied earlier or studying currently.
8. The progress of the mini project is monitored by the mentor and coordinator **every week**. Each student has to maintain a **project diary** duly signed by the mentor

Assessment:

1. 10% Early proposal (abstract)
2. 50% Continuous evaluation (progress of the project including literature review, design, development, coding, documentation according to the time lines)
3. 20% presentation and demonstration (structured, fluent, logic, output) ; 10% Viva Voce (Evaluated by internal PRC-Project Review Committee)
4. 10% Final Report writing

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Report: A report must contain the complete project details. The layout or the organization of the report as follows:

- Summary / Abstract
- Introduction
- Software specifications
- Design of the problem (Block diagram / structured chart; Flow Chart functions or Pseudocode for the subprogram
- Results and Discussions
- Conclusion and Future work
- References, Appendix and coding. System manual-How to use the system

Note: Please find the specimen copy of the project report in the institute website.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
SCHEME OF INSTRUCTION AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING

SEMESTER –VI

S. No	Course Code	Title of the Course	Scheme of Instruction: Hours per Week			Duration of SEE in Hours	Scheme of Examination: Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
THEORY									
1	18CSC23	Data Communication and Computer Networks	3	0	0	3	30	70	3
2	18CSC24	Software Engineering	3	0	0	3	30	70	3
3	18CSC25	Artificial Intelligence	3	0	0	3	30	70	3
4	18CSE XX	Professional Elective-II	3	0	0	3	30	70	3
5	18CSE XX	Professional Elective-III	3	0	0	3	30	70	3
6	18MBC 01	Engineering Economics and Accountancy	3	0	0	3	30	70	3
7	18EEM 01	Indian Traditional Knowledge	2	0	0	2	-	50	0
PRACTICAL									
8	18CSC26	Data Communication and Computer Networks Lab	0	0	3	3	25	50	1.5
9	18CSC27	Case Study	0	0	2	2	50	-	1
		TOTAL	**20**	**00**	**05**		**255**	**520**	**20.5**

PROFESSIONAL ELECTIVE-II	
Course Code	**Title of the Course**
18CSE09	Internet of Things
18CSE10	Parallel and Distributed Algorithms
18CSE11	Cloud Computing
18CSE12	Computer Vision

PROFESSIONAL ELECTIVE-III	
Course Code	**Title of the Course**
18CSE13	Soft Computing
18CSE14	Network and System Administration
18CSE15	Mobile Computing
18CSE16	Free and Open-Source Software

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

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18CSC23

DATA COMMUNICATION AND COMPUTER NETWORKS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basic programming and problem solving.

Course Objectives: The objectives of this course are

1. To understand the principles of data communication and organization of computer networks
2. To analyze various routing and congestion control algorithms.
3. To study the functionality of the transport layer and understanding different application layer protocols.

Course Outcomes: On Successful completion of this course, student will be able to

1. Define the communication protocol suites like ISO-OSI and TCP/IP.
2. Illustrate and explain Data Communications System and its components.
3. Identify and analyze various routing algorithms, congestion control algorithms.
4. Distinguish the internet protocols like IP, ARP, ICMP, IGMP, BGP, OSPF, and DHCP.
5. Outline the transport layer protocols like TCP, UDP, RTCP.
6. List and examine the applications of HTTP, WWW, DNS, Email, FTP and the underlying protocols.

UNIT - I

Introduction: Data communication, network types and models, TCP/IP and OSI Protocol Suite, transmission media (wired and wireless), switching.

UNIT - II

Data Link Layer: Design issues, error detection and correction, elementary data link protocols, sliding window protocols, multiple access protocols.

LAN: Wired LAN, wireless LAN, connecting devices and wireless LAN.

UNIT - III

Network Layer: Network layer design issues, routing algorithms, congestion control algorithms, Quality of service, IPV4, IPV6, Internet, network layer protocols -ARP, RARP, BOOTP and DHCP.

UNIT - IV

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP, congestion control, quality of service.

UNIT - V

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls.

Textbooks:

1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw– Hill, Fifth Edition, 2013.
2. S. Tanenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2013
3. William Stallings, “Data and Computer Communication”, Eighth Edition, Pearson Education, 2007.

Suggested Reading:

1. Larry L.Peterson, Peter S. Davie, “Computer Networks”, Elsevier, Fifth Edition, 2012. 2. James F. Kurose, Keith W. Ross, “Computer Networking: A Top–Down Approach Featuring the Internet”, Pearson Education, 2005.

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105081/
2. https://nptel.ac.in/courses/106/106/106106091/

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18CSC24

SOFTWARE ENGINEERING

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To understand the Software Engineering Practice & Process Models.
2. To understand Design Engineering, and Software Project Management.
3. To gain knowledge of the overall project activities.

Course Outcomes: On Successful completion of this course, student will be able to

1. State the software process and the perspective process model, evolutionary and agile process models.
2. Interpret the Requirements of Software Product and Estimate the cost of software using empiricalmodels.
3. Demonstrate the skills necessary to specify the requirements of software product.
4. Recall the design principles and construct a product using coding principles and standards.
5. Prepare test cases and Apply software testing methods like White Box, Black box, and O-O.
6. Identify the configuration Management and estimates software quality and metrics of maintenance.

UNIT - I

Introduction to Software Engineering: The nature of Software, Software Engineering, The Software Process**,** Software Engineering Practice. **Process Models:** A Generic Process Model, Process Framework, CMMI, Prescriptive Process Models: Waterfall Model, Incremental Process Models, Evolutionary Process Models -Prototyping, The Spiral Model, Concurrent Models. **An Agile View of Process**: Agility, Agile Process, and Agile Process Models- Extreme Programming (XP), Adaptive Software Development (ASD).

UNIT - II

Requirement Engineering: Understanding Requirements: Establishing the Groundwork, Requirement Engineering tasks, Initiating the Requirements Engineering Process, Eliciting Requirements. **Software Requirements Analysis and Specification**: Problem Analysis, Requirements Specification, Decision Tables, SRS Document, IEEE Standards for SRS, Case Studies. **Planning and Managing the Project**: Managing Software Project, Project Personnel, Effort Estimation, Risk Management, the Project Plan and Software project estimation – Empirical estimation models.

UNIT - III

Design Engineering: Design Principles, Design Notation and Specification, Design Concepts, Flow oriented modeling. The function-oriented design for the case studies, O-O Design Concepts, Modeling Component-Level Design. **Architectural Design:** Software Architecture, Data Design, A Brief Taxonomy of Architectural Styles. **Implementation:** Coding Principles and Standards, Coding Process, Code Verification.

UNIT - IV

Testing Strategies: A Strategic approach to software testing, strategic issues, test strategies for Conventional and O-O Software, Validation Testing, System Testing, Art of Debugging. **Testing Tactics**: Software Testing Fundamentals, White Box Testing: Basis Path Testing, Control Structure Testing, O-O Testing methods. Black Box Testing

UNIT - V

Software Quality Assurance – Managing Software Project, Quality concepts Software Quality Assurance Software Reviews, Technical Reviews, Software Reliability. **Software Configuration Management**: Identification of Objects in the Software Configuration, Configuration Audit, SCM standards. **Software Maintenance**: Categories of Maintenance, Software reuse, Metrics for maintenance.

Text Books:

1. Roger S. Pressman, "Software Engineering: A practitioner's approach", 7th edition, McGraw Hill, 2010.
2. Shari Lawrence Pfleeger, "Software Engineering Theory and Practices", 4th Edition, Pearson Education, India, 2011.
3. Pankaj Jalote"An integrated approach to Software Engineering", Springer/ Narosa, 2014

Suggested Reading:

1. Sommerveli "Software Engineering", 10TH Edition, Pearson,2015
2. Rajib Mal "Fundamental of Software Engineering", 4th Edition, PHI Learning, 2014.

Online Resources:

1. https://nptel.ac.in/courses/106101061/

18CSC25

ARTIFICIAL INTELLIGENCE

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Data structures, Discrete Mathematics, Probability Theory.

Course Objectives: The objectives of this course are

1. To list the significance of AI.
2. To discuss the various components that is involved in solving an AI problem.
3. To analyze the various knowledge representation schemes, reasoning and learning techniques of AI.

Course Outcomes: On Successful completion of this course, student will be able to

1. Explain the role of agents and interaction with the environment to establish goals.
2. Identify and formulate search strategies to solve problems by applying suitable search strategy.
3. Compare and contrast the various knowledge representation schemes of AI.
4. Appraise probabilistic reasoning and Markov decision process to solve real world problems.
5. Apply the AI concepts to build an expert system to solve the real-world problems.
6. Describe learning paradigms in machine learning.

UNIT - I

Introduction: Concept of AI, history, current status, scope, Problem Formulations, Review of tree and graph structures. **Intelligent agents:** Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - II

Problem Solving - State - Space Search and Control Strategies: State space representation, Search graph and Search tree. Random search, Search with closed and open list, Depth first and Breadth first search. Heuristic search, Best first search. A* algorithm, problem reduction, constraint satisfaction, Game Search, minmax algorithm, alpha beta pruning.

UNIT - III

Logic Concepts and Logic Programming: Introduction, Propositional Calculus Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Table, A System in Propositional Logic, Resolution, Refutation in Propositional Logic, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT - IV

Probabilistic Reasoning: Probability, inference using full joint distributions, Bayes rule, Bayesian networks-representation, construction, exact and approximate inference, temporal model, hidden Markov model. **Markov Decision process:** MDP formulation, utility theory, multi attribute utility functions, decision networks, value iteration, policy iteration and partially observable MDPs.

UNIT - V

Expert System and Applications: Introduction, Phases in Building Expert Systems Expert System Architecture, Expert Systems Vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and tools. **Machine - Learning Paradigms:** Introduction, Machine learning System, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees, Deductive Learning, Clustering.

Text Books:

1. Russell, Norvig, “Artificial Intelligence: A Modern Approach”, Pearson Education, 3nd Edition, 2010.
2. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, First Edition, 2011.

Suggested Reading:

1. Rich, Knight, Nair, “Artificial Intelligence”, Tata McGraw Hill, 3rd Edition 2009.
2. Trivedi. M.C., “A classical approach to Artificial Intelligence”, Khanna Publishing House, Delhi.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

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18MBC01

ENGINEERING ECONOMICS AND ACCOUNTANCY

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are:

1. To demonstrate the importance of Managerial Economics in decision making.
2. To understand the importance of project evaluation in achieving a firm's objective.
3. To explain the concept of Accountancy and provide basic knowledge on preparation and analyzing of Final accounts.

Course Outcomes: On Successful completion of this course, student will be able to:

1. Apply fundamental knowledge of Managerial economics concepts and tools.
2. Understand various aspects of demand analysis and forecasting
3. Analyze production and cost relationships to make best use of resources available.
4. Analyze different opportunities and come out with best feasible capital investment decisions
5. Apply accountancy concepts and conventions and preparation of final accounts.

UNIT - I

Introduction to Managerial Economics : Introduction to Economics and itsevolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

UNIT II –

Demand and Supply Analysis : Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

UNIT III –

Production and Cost Analysis: Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns; Internal and External Economies of Scale.
Cost Analysis: Cost concepts Types of Costs, Cost-Output Relationship Short Run and Long Run; Market structures Types of Competition, Features, Price Output Determination under Perfect Competition, Monopoly and Monopolistic Competition; Break-even Analysis Concepts, Assumptions, Limitations, Numerical problems.

UNIT IV –

Accountancy: Book-keeping, Principles and Significance of Double Entry Book Keeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments. Ratio Analysis.

UNIT V –

Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical problems.

Text Books:

1. MehtaP.L.,"Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's
2. Educational publishers, 2016.
3. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 11th Edition, 2013. PandayI.M. "Financial Management", 11th edition, Vikas Publishing House, 2015.

Suggested Readings:

1. Varshney and KL Maheswari, "Managerial Economics", Sultan Chand, 2014.
2. M.Kasi Reddy and S.Saraswathi, "Managerial Economics and Financial Accounting", Prentice Hall of India Pvt Ltd, 2007.
3. A.R.Aryasri, "Managerial Economics and Financial Analysis", McGraw-Hill, 2013.

18EEM 01

INDIAN TRADITIONAL KNOWLEDGE

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Credits	0

Course Objectives: The objectives of this course are :
1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the culture, civilization, and heritage of Ancient, Medieval and Modern India.
2. Distinguish various Languages and Literature existing in India
3. Discuss and Compare Philosophy and Religion in Indian since ancient times
4. Explore various Fine arts in Indian History, and Illustrate the development of Science and Technologyin India.
5. Describe the Indian Education System, and recognize the efforts of scientist to the development ofIndia

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II

Indian Languages, Culture and Literature:
Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.
Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV

Fine arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT-V

Education system in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:
1. Kapil Kapoor, "Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. S. Narain, "Examinations in ancient India", Arya Book Depot, 1993
4. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
5. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Reading:
1. Kapil Kapoor, "Language, Linguistics and Literature: The Indian Perspective", ISBN-10: 8171880649, 1994.
2. Karan Singh, "A Treasury of Indian Wisdom: An Anthology of Spiritual Learn", ISBN: 978-0143426158, 2016.

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18CSC26

DATA COMMUNICATION AND COMPUTER NETWORKS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Basics of Operating System, Linux Commands.

Course Objectives: The objectives of this course are

1. To familiarize students with the communication media, devices, and protocols.
2. To expose students to gain practical knowledge of computer networks configuration and monitoring.
3. To create network simple computer networks using simulation tools.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify the different types of equipment like cables used in the networks Lab.
2. Recognize the various network devices like repeater, hub, switch.
3. Practice the basic network commands like ifconfig, ping, traceroute, nslookup, dig, arp, netstat, nmap.
4. Design and demonstrate network topologies using NS3 simulation tool.
5. Examine the packet transfer using NetAnim.
6. Analyze the network performance using Wire shark or any tool.

LIST OF EXPERIMENTS:

1. Study of Network media, cables, and devices and Cable Construction
2. Demonstration of basic network commands/utilities (both in Windows and Linux)
3. PC Network Configuration
4. Building a switch-based network / Configuration of Cisco Catalyst Switch 3560
5. Configuration of Cisco Router 2900
6. Basic OSPF configuration
7. Basic EIGRP Configuration
8. Analysis of network traces using tcpdump
9. Analysis of network traces using Whireshark

Textbooks:

1. S. Tanenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2013.

Online Resources:

1. https://learningnetwork.cisco.com/s/question/0D53i00000Kt7EkCAJ/tools-for-ccnp-network- simulator-lab-tasks
2. https://www.packettracernetwork.com/
3. https://www.ghacks.net/2019/11/13/gns3-is-an-open-source-graphical-network-simulator-for- windows-linux-and-macos/
4. https://www.imedita.com/blog/top-10-list-of-network-simulation-tools/

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18CSC27

CASE STUDY

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Case studies are common in engineering where we analyse (study) situations. Case study exercise is a realistic simulation of a real life situation or strategic problem we are likely to encounter in our workplace or surroundings. A case study is actually “analysing, applying engineering and science knowledge, reasoning and drawing conclusions” to solve a real situation. Case studies are different types including historical, real life, problem oriented etc.

Course Objectives: The objectives of this course are
1. To expose students to real life problems/events/situations and technologies
2. To promote individual study, critical thinking and group discussions to build team work
3. To inculcate the culture of self-learning, professional ethics communication

Course Outcomes: On successful completion of the case study, students will be able to
1. Understand real life situations, problems, developments of technologies in Computer science
2. Interpret, analyse, and think critically about the events, situations and gather information from varioussources for formulating solutions
3. Apply learned knowledge and commit to decisions
4. Evaluate the approach and solution to the event/problem by considering efficiency and optimization
5. Communicate efficiently both in written and orally to discuss the recommendations

Suggestions to select case studies
- For a real situation case study, you can choose an event at your workplace to analyse.
- For a historical case study, you can take a recent collapse/development of a company /technology /project (Cambridge Analytica, Google, Facebook, AI, ML, IoT, GitHub, GNU, LibreOffice, FOSS etc.) and analyse what went wrong or gave raise.
- For a problem oriented case study, choose a problem where they need to (Situation-- Problem-Solution(s)--Evaluation):
  - understand the situation faced (significance),
  - analyse the specific problem to be tackled,
  - create, analyse, and refine a solution and
  - further evaluate, improve and implement

Instructions:
- Students need to choose a case in consultation with any one of their class teachers and mentor
- The topic should be confined to the areas/courses of AI, SE, IoT,
- Submit an abstract consisting of the significance, objectives, methodology and work plan by the end of 3rd week
- Every week they need to show progress to the concerned teacher and mentor
- Shall present/demonstrate and submit a report(read the Case Study guide lines)

Assessment: The main focus of case studies are to assess the approach and the solution arrived. In fact, case studies are usually designed not to have one ‘correct’ answer. As long as the students justify their recommendation, and stand up to interrogation from the assessor, they are likely to score marks. Students will be monitored by an internal teacher along with their mentors and evaluated by the external examiner at end.

18CSE09

INTERNET OF THINGS
(PROFESSIONAL ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Computer Architecture and Microprocessor, Programming Basics.

Course Objectives: The objectives of this course are

1. Impart necessary and practical knowledge of components of Internet of Things.
2. Understand IoT Protocols.
3. Develop skills required to build real-time IoT based projects.

Course Outcomes: On Successful completion of this course, student will be able to

1. Identify hardware and software components of Internet of Things.
2. Interface Input-Output devices, sensors with Arduino and Raspberry Pi using communication modules.
3. Analyze the use of communication protocols in IoT.
4. Remotely monitor data and subsequently control various devices.
5. Develop real time IoT based projects.
6. Applications of IoT in various domains such as health care, industrial automation.

UNIT - I

Introduction to IoT: Architectural Overview, Design principles and requirements of IoT, IoT Applications. **Elements of IoT:** Basics of networking, sensors, actuators, computing devices, software, data management and processing environment and Security issues.

UNIT - II

IoT Hardware Components: Computing (Arduino, Raspberry Pi), Communication, Sensors, Actuators, I/0 interfaces, Programming API's (for Arduino and Rasp berry Pi).

UNIT - III

IoT Protocols: 6LowPAN,RPL, IPV6, WiFi, ZigBee, Bluetooth, BLE, MQTT, CoAP, RFID.

UNIT - IV

IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

UNIT - V

IoT Case Studies: IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.

Text Books:

1. Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, “Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers, Series in Communications, 2013.

Online Resources / Web links / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, “Internet of Things in Industries: A Survey “, IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik , JP. Vasseur, R. Alexander, “RPL: IPv6 Routing Protocol for Low-Power and Lossy Networks”, IETF, Standards Track, Mar. 2012.

3. Z. Shelby, K. Hartke, C. Bormann, “The Constrained Application Protocol (CoAP)”**,** Internet Engineering Task Force (IETF), Standards Track, 2014.
4. L.Fenzel, “What’s The Difference Between IEEE 802.15.4 And ZigBee Wireless?”, Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, "Information theoretic self-management of Wireless Sensor Networks", Proceedings of NCC 2013.
6. F. Luo et al., "A Distributed Gateway Selection Algorithm for UAV Networks," in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22-33, March 2015.

Professor and Head Department

18CSE10

PARALLEL AND DISTRIBUTED ALGORITHMS
(PROFESSIONAL ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are
1. To acquaint students with the basic concepts of parallel and distributed computing.
2. To provide knowledge of parallel computing platforms.
3. To learn parallel and distributed algorithms development techniques for shared memory and message passing models.
4. To equip the students with modern parallel and distributed approaches for solving problems in emerging applications.

Course Outcomes: On Successful completion of this course, student will be able to
1. Describe the models and techniques for parallelization.
2. Make use of list ranking and graph coloring parallel Algorithms.
3. Analyze parallel algorithms and compute their complexity measures.
4. Develop parallel programs for search and matrix multiplication using open MP.
5. Choose a parallel algorithm that makes good use of the target Architecture.
6. Describe the distributed Algorithms to learn its models and complexity measures.

UNIT - I
The Idea of Parallelism: A Parallelized version of the Sieve of Eratosthenes. PRAM Model of Parallel Computation. Pointer Jumping and Divide & Conquer: Useful Techniques for Parallelization.

UNIT - II
PRAM Algorithms: Parallel Reduction, Prefix Sums, List Ranking, Preorder Tree Traversal, Merging Two Sorted Lists, Graph Coloring, Reducing the Number of Processors and Brent's Theorem, Dichotomy of Parallel Computing Platforms, Cost of Communication, Programmer's view of modern multi-core processors.

UNIT - III
The role of compilers and writing efficient serial programs, Parallel Complexity: The P-Complete Class, Mapping and Scheduling, Elementary Parallel Algorithms for Sorting.

UNIT - IV
Parallel Programming Languages: Shared Memory Parallel Programming using OpenMP
Writing efficient openMP programs, Dictionary Operations: Parallel Search, Graph, Algorithms and Matrix Multiplication.

UNIT - V
Distributed Algorithms: models and complexity measures. Safety, liveness, termination, logical time and event ordering, Global state and snapshot algorithms, Mutual exclusion and Clock Synchronization, Distributed Graph algorithms.

Text Books:
1. Michael J Quinn, “Parallel Computing: Theory and practice”, Tata McGraw Hill, 1993.
2. Roman Trobec, Boštjan Slivnik, Patricio Bulić, Borut Robič, “Introduction to Parallel Computing”, Springer, 2018.
3. Joseph Jaja, “Introduction to Parallel Algorithms”, First Edition, Addison Wesley, 1992.

Suggested Reading:
1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, “Introduction to Parallel Computing”, Second Edition, Addison Wesley, 2003

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc19_cs17/preview
2. https://nptel.ac.in/courses/106102163/

Professor and Head Department

18CSE11

CLOUD COMPUTING
(PROFESSIONAL ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are:
1. To impart the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they can adopt Cloud Computing services and tools in their real life scenarios.
3. To provide knowledge about security and privacy issues related to cloud computing environments.
4. To enable students explore cloud computing driven commercial systems such as Google App Engine, Microsoft Azure and Amazon Web Services and others

Course Outcomes: On successful of the course student will be able to:
1. Define Cloud Computing and related concepts and describe the characteristics, advantages, risks and challenges associated with cloud computing.
2. Explain and characterize various cloud service models, cloud deployment models.
3. Explore virtualization techniques that serve in offering software, computation and storage Services onthe cloud.
4. Illustrate the concepts of cloud storage and demonstrate their use in storage systems such as AmazonS3 and HDFS.
5. Understand the security and privacy issues related to cloud computing environments.
6. Investigate/Interpret the security and privacy issues related to cloud computing environments.

UNIT - I
Introduction to Cloud Computing: Cloud Computing in a Nutshell, System Models for Distributed and Cloud Computing, Roots of Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, Basic Principles of Cloud Computing, Challenges and Risks, Service Models.

UNIT - II
Virtual Machines and Virtualization of Clusters and Data Centers: Levels of Virtualization, Virtualization Structures//Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization Data-Center Automation. Case studies: Xen Virtual machine monitors- Xen API. VMware - VMware products-Vmware Features. Microsoft Virtual Server - Features of Microsoft Virtual Server.

UNIT - III
Cloud computing architectures over Virtualized Data Centers: Data-Center design and Interconnection networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, GAE, AWS, Azure, Inter-cloud Resource Management.

UNIT - IV
Cloud Security and Trust Management, Data Security in the Cloud : An Introduction to the Idea of Data Security, The Current State of Data Security in the Cloud, CryptDb: Onion Encryption layers-DET,RND,OPE,JOIN,SEARCH, HOM, and Homomorphic Encryption, FPE. Trust, Reputation and Security Management.

UNIT - V
Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, parallel and distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments. Common Standards in Cloud Computing: The Open Cloud Consortium, the Distributed Management Task Force, Standards for Application Developers, Standards for Messaging. Internet Messaging Access Protocol (IMAP), Standards for Security, Examples of End-User Access to Cloud Computing.

Text Books:

1. John W. Rittinghouse, "Cloud Computing: Implementation, Management, and Security ". James F. Ransome, CRC Press 2009.
2. Kai Hwang. Geoffrey C.Fox, Jack J. Dongarra, "Distributed and Cloud Computing From Parallel Processing to the Internet of Things", Elsevier, 2012.
3. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski," Cloud Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing), Wiley Publishing ©2011.

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Suggested Reading:

1. Raluca Ada Popa, Catherine M.S. Redfield, Nickolai Zeldovich, and Hari Balakrishnan, "CryptDB: Protecting Confidentiality with encrypted Query Processing", 23rd ACM Symposium on Operating Systems Principles (SOSP 2011), Cascais, Portugal October 2011.
2. A Fully Homomorhic Encryption Scheme, Craig Gentry, September 2009.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

Online Resources:

1. http://aws.amazon.com
2. http://code.google.com/appsengine
3. http://www.buyya.com/

18CSE12

COMPUTER VISION
(PROFESSIONAL ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Linear Algebra and Probability, Digital Image Processing.

Course Objectives: The objectives of this course are
1. To understand the Fundamental Concepts Related To Multi-Dimensional Signal Processing.
2. To understand Feature Extraction algorithms.
3. To understand Visual Geometric Modeling and Stochastic Optimization.

Course Outcomes: On Successful completion of this course, student will be able to
1. Recognize the basic fundamentals of vision and describe the scope of challenges.
2. Develop algorithms to analyze feature detection and feature alignment.
3. Analyze images and videos for problems such as tracking and structure from motion.
4. Choose object, scene recognition and categorization algorithms for real time images.
5. Explain recovery of 3D structure of ill-posed scenes.
6. Apply various techniques to build computer vision applications.

UNIT - I

Introduction to Computer Vision and Image Formation: Introduction, Geometric primitives and transformations, Photometric image formation, Digital Camera image formation. **Image Processing:** Point operators, Linear filtering, More neighborhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations.

UNIT - II

Feature detection and matching: Points and patches, Edges, Lines. **Segmentation**: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts. **Feature-based alignment**: 2D and 3D feature-based alignment, Pose estimation.

UNIT - III

Structure from motion: Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, Constrained structure and motion. **Dense motion estimation:** Translational alignment, Parametric motion, Spline-based motion, Optical flow, Layered motion.

UNIT - IV

Recognition: Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding.

UNIT - V

3D Reconstruction: Shape from X, Active range finding, Surface representations, Point-based representations, volumetric representations, Model-based reconstruction, Recovering texture maps.

Text Books:

1. Richard Szeliski "Computer Vision: Algorithms and Applications", Springer-Verlag London Limited, 2011.
2. R. C. Gonzalez and R. E. Woods, "Digital Image Processing"; Addison Wesley, 2008.

Suggested Reading:

1. Robert J. Schallkoff, "Pattern Recognition: Statistical. Structural and Neural Approaches", John Wiley and Sons; 1992+.
2. D. A. Forsyth and J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
3. R. Hartley and A. Zisserman, "Multiple View geometry", Cambridge university Press, 2002.
4. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.
5. K. Fukunaga; "Introduction to Statistical Pattern Recognition", Second Edition, Academic Press, Morgan Kaufmann, 1990.

Online Resources:
1. CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline
2. Computer Vision Homepage: http://www2.cs.cmu.edu/afs/cs/project/cil/ftp/html/vision.html

18CSE13

SOFT COMPUTING
(PROFESSIONAL ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Fundamental Mathematics.

Course Objectives: The objectives of this course are
1. To learn various types of soft computing techniques and their applications.
2. To acquire the knowledge of neural network architectures, learning methods and algorithms.
3. To understand Fuzzy logic, Genetic algorithms and their applications.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand various soft computing techniques.
2. Analyze and design various learning models and Neural Network Architectures.
3. Apply the Neural Network Architecture for various Real time applications.
4. Understand approximate reasoning using fuzzy logic.
5. Analyze and design Genetic algorithms in different applications.
6. Apply soft computing techniques to solve different applications.

UNIT - I
Soft computing vs. Hard computing, Various types of soft computing techniques.
Artificial Neural Networks: Fundamental concepts, Evolution of neural networks, Basic models of artificial neural network, important terminologies of ANNs. McCulloch-Pitts neuron, linear separability, Hebb network.

UNIT - II
Supervised Learning Neural Networks: Perceptron networks, Adaptive linear neuron (Adaline), Multiple Adaptive linear neuron (Madaline), Back propagation network.

UNIT - III
Unsupervised Learning Neural Networks: Kohonen Self Organizing networks, Adaptive resonance theory. **Associate Memory Networks:** Bidirectional associative memory network, Hopfield networks.

UNIT - IV
Fuzzy Logic: Introduction to classical sets and Fuzzy sets, Fuzzy relations, Tolerance and equivalence relations, Membership functions, Defuzzification.

UNIT - V
Genetic Algorithms: Introduction, Basic operators and terminology, Traditional algorithm vs. genetic algorithm, Simple genetic algorithm, General genetic algorithm, Classification of genetic algorithm, Genetic programming, Applications of genetic algorithm.

Text Books:
1. S.N. Sivanandam& S.N. Deepa, “Principles of soft computing”, Wiley publications, 2nd Edition, 2011.

Suggested Reading:
1. S. Rajasekaran& G.A. Vijayalakshmipai, “Neural Networks, Fuzzy logic & Genetic Algorithms, Synthesis & Applications”, PHI publication, 2008.
2. LiMin Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill edition, 1994.
3. K.L.Du& M.N.S Swamy, “Neural Networks in a Soft Computing Framework”, Springer International edition, 2008.
4. Simon Haykins, “Neural Networks a Comprehensive Foundation”, PHI, second edition.
5. Goldberg, David E., “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, New Delhi, 2002.
6. N.P. Padhy and S.P. Simon, ”Soft Computing: With Matlab Programming”, Oxford University Press, 2015.

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc18_cs13/preview.

18CSE14

NETWORK AND SYSTEM ADMINISTRATION
(PROFESSIONAL ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System Concepts, Data Communications and Computer networks

Course Objectives: The objectives of this course are
1. To study about the operation of computers, servers and the networking
2. Familiarize the students with system and network administration tools.
3. Prepare the students to analyze the performance of system and network to resolve the issues

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify and define the the basic system administration and networking tools
2. Illustrate system boot process, administration tools
3. Configure various services like mail, ftp, web hosting, security, use remote administration tools
4. Analyze and interpret log messages for troubleshooting the issues
5. Measure and evaluate the performance of system and network,
6. Write scripts to automate system administration process

UNIT - I
Networking Overview: History, Protocol Standards, Reference Models (ISO-OSI, TCP/IP), Windows and Linux networking basics, switching and routing basics.
Server Administration Basics: Server and Client Installation, Boot Process and Startup Services: Xinetd, Managing accounts: users, groups and other privileges, File Systems and Quota Management , Job Scheduling with cron, crontab, anacron and system log analysis, Process controlling and management, Online Server upgrade/update process.

UNIT - II
Network Configuration Basics: IPv4 and IPv6 addressing, Network Interface Configuration, Diagnosing Network startup issues, Linux and Microsoft, Firewall configuration, Network troubleshooting commands. **Dynamic Host Configuration Protocol (DHCP),** DHCP Principle, DHCP Server Configuration DHCP Options, Scope, Reservation and Relaying, DHCP Troubleshooting.

UNIT - III
Name Server and Configuration: DNS principles and Operations, Basic Name Server and Client Configuration, Caching Only name server, Primary and Slave Name Server, DNS Zone Transfers, dynamic Updates, delegation, DNS Server Security, troubleshooting.
Web and Proxy Server Configuration: HTTP Server Configuration Basics, Virtual Hosting, HTTP Caching, Proxy Caching Server Configuration, Proxy ACL, Proxy-Authentication Mechanisms, Troubleshooting.

UNIT - IV
FTP, File and Print Server: General Samba Configuration, SAMBA SWAT, NFS and NFS Client Configuration, CUPS configuration basics, FTP Principles, Anonymous FTP Server, Troubleshooting.
Mail Server basics: SMTP, POP and IMAP principles, SMTP Relaying Principles, Mail Domain Administration, Basic Mail Server Configuration, SPAM control and Filtering.

UNIT - V
Remote Administration and Management: Router Configuration, Webmin/ usermin, Team Viewer, Telnet, SSH, SCP, Rsync.

Text Books / Suggested Reading:

1. Thomas A. Limoncelli, Christina J. Hogan , Strata R. Chalup, “The Practice of System and Network Administration”, Pearson Education, Second Edition, 2012
2. Roderick W. Smith, “Advanced Linux Networking, Addison”, Wesley Professional (Pearson Education), 2002.
3. Tony Bautts, Terry Dawson, Gregor N. Purdy, “Linux Network Administrator’s Guide”, O’Reilly Publisher, Third Edition, 2005

Suggested readings:

1. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, "UNIX and Linux System Administration Handbook", Fifth Edition, 2017, Addison Wesley

Online resource:

1. https://study-ccna.com/
2. https://www.edx.org/course/it-support-networking-essentials

Professor and Head Department

18CSE15

MOBILE COMPUTING
(PROFESSIONAL ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are:
1. Understand the concepts of mobile computing
2. Study network layer and transport layer protocols and Ad-Hoc networks.
3. Discuss about mobile platforms and application development.

Course Outcomes: On Successful completion of this course, student will be able to
1. Explain the basics of mobile telecommunication systems
2. Illustrate the generations of telecommunication systems in wireless networks
3. Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network
4. Explain the functionality of Transport and Application layers
5. Develop a mobile application using android/blackberry/ios/Windows SDK

UNIT-I

Introduction: Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA.

UNIT-II

Mobile Telecommunication System: Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security.

UNIT-III

Mobile Network Layer: Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.

UNIT-IV

Mobile Transport And Application Layer: Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

UNIT-V

Mobile Platforms And Applications: Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

Text Books:

1. Jochen Schiller, “Mobile Communications”, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi – 2012
3. Rajkamal, “Mobile Computing”, University press publications, 2014.

Suggested Reading :

1. Dharma Prakash Agarval, Qing and An Zeng, “Introduction to Wireless and Mobile systems”, Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
3. William.C.Y.Lee, “Mobile Cellular Telecommunications-Analog and Digital Systems”, Second Edition,TataMcGraw Hill Edition ,2006.
4. C.K.Toh, “AdHoc Mobile Wireless Networks”, First Edition, Pearson Education, 2002.

Online Resources :
1. Android Developers : http://developer.android.com/index.html
2. Apple Developer : https://developer.apple.com/
3. Windows Phone DevCenter : http://developer.windowsphone.com
4. BlackBerry Developer : http://developer.blackberry.com

18CSE16

FREE AND OPEN SOURCE SOFTWARE (FOSS)
(PROFESSIONAL ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are:
1. Familiarize the students with Open Source Technologies.
2. Expose students with OSS Projects, Advantages of Open Source.
3. Make the students understand the principles, methodologies, policies, licensing procedures and ethicsof FOSS.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Identify various FOSS tools, platforms, licensing procedures and development models, ethics
2. Describe various FOSS projects, development models and project management
3. Adapt to the usage of FOSS tools and technologies.
4. Distinguish between Proprietary and Open Source tools, development methods
5. Evaluate various Open Source projects like Linux, Apache, GIT
6. Practice Open Source principles, ethics and models.

UNIT - I

Introduction to Open Source: Open Source, need and principles of OSS, Open Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT – II

Fault Tolerant Design: **Principles and Open Source Methodology**- History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT – III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, LibreOffice.

UNIT – IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media

What Is A License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT – V

Open Source Ethics- Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:
1. Kailash Vadera, Bhavyesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press.

Suggested Reading:
1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, "Perspectives on Free and Open Source Software", MIT press.

Online Resources:
1. https://fossee.in/
2. https://opensource.com
3. https://www.gnu.org/

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Choice Based Credit System (CBCS)

Name of the Programme (UG):

B.E Syllabus for Semester VII and VIII - Semester

With effect from 2019 - 2020

Specialization /Branch: Computer Science and Engineering

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Hyderabad-500075, Telangana State.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTION AND EXAMINATION
VII-Semester of B.E under CBCS
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-VII

Sl.No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L/T	Scheme of Instruction: Hours per week P/D	Scheme of Examination: Duration of SEE in Hours	Maximum Marks CIE	Maximum Marks SEE	Credits
THEORY								
1	16CSC 33	Data Science and Big Data Analytics	3	-	3	30	70	3
2	16CSC 34	Free and Open Source Software	3	-	3	30	70	3
3	16CSC 35	Distributed and Cloud Computing	3	-	3	30	70	3
4	16CSC 36	Machine Learning	3/1	-	3	30	70	4
5		Elective-IV	3	-	3	30	70	3
6		Elective-V	3	-	3	30	70	3
PRACTICALS								
7	16CSC 37	DSBDA Lab	-	3	3	25	50	2
8	16CSC 38	ML Lab	-	3	3	25	50	2
9	16CSC 39	Project Seminar	-	3	3	50	-	2
TOTAL			**19**	**9**		**280**	**520**	**25**

ELECTIVE-IV	
16CSE 10	Deep Learning
16CSE 11	Design Patterns
16CSE 12	Nature Inspired Algorithm
16CSE 13	System and Network Administration

ELECTIVE-V (OE1)	
16CEO 02	Disaster Mitigation and Management
16MEO 01	Entrepreneurship
16MEO 06	Research Methodologies
16EGO 02	Gender Sensitization

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

NPTEL Courses (Enrollment :15-05-2019 to 29-07-2019)				
Exam Registration (Open and Close Dates) : 1-Jun-19 to 23-09-2019 10.00 am				
Courses	**Elective**	**Course Start Date**	**Course End Date**	**Exam Date**
Software Project Management	Elective - IV	29-07-2019	18-10-2019	02-11-2019
Ethical Hacking		29-07-2019	18-10-2019	02-11-2019
Natural Language Processing		29-07-2019	18-10-2019	02-11-2019
Block Chain Architecture Design and Use cases	Elective - V	29-07-2019	18-10-2019	03-11-2019
Social Networks		29-07-2019	18-10-2019	02-11-2019
Computer Vision		29-07-2019	18-10-2019	02-11-2019

Assessment Procedure				
Course (in terms of credits)	**Continuous Internal Evaluation (Marks)**	**Semester end Examination (Marks)**	**Remarks**	**Duration of Semester End Examination**
Three(3)Credits/ Four(4)credits	30*	70**	Theory Course/ Engg . Graphics	3 Hours
Two(2) Credits	25	50	Lab Course/Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
One(1) Credit	50	-	Mini Project	-

* Out of 30 CIE, 10 marks are allotted for slip-tests (Three slip tests will be conducted, each of ten marks, and average of best two is considered) and the remaining 20 marks are based on the average of two tests, weightage for each test is 20 marks.

** The question paper will be in two parts, Part-A and Part-B. Part A is compulsory and contains short answer questions covering the entire syllabus, and carries 20 marks. Part-B carries 50 marks and covers all the units of the syllabus (student has to answer five out of seven questions).

Note: A course that has CIE but no SEE as per scheme is treated as PASS/FAIL for which pass marks are **50%** of CIE.

A candidate has earned the credits of a particular course, if he/she secures not less than the minimum marks/ grade as prescribed. Minimum pass marks in the SEE plus CIE shall be 40% for theory courses/subjects and **50%** for lab courses /Mini Project/ Project.

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16CSC 33

DATA SCIENCE AND BIG DATA ANALYTICS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre Requisites: DBMS, Probability and Statistics

Course Objectives: The main objectives of this course are:
1. Introduce a data analytics problem solving framework
2. Develop technical skills in probability modeling and statistical inference for the practical application of statistical methods.
3. Use existing and develop new statistical tools for data science problems across different applied domains.

Course Outcomes: On successful of this course student will be able to:
1. Understands various phases of the data analytics life cycle.
2. Apply statistical methods to data for inferences.
3. Analyze data using Classification, Graphical and computational methods.
4. Understands Big Data technologies and NOSQL.
5. Analyze various types of data using Data Analytics Techniques.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	-	-	-	1	-	-	-	-	-	-	1	-
2	3	1	2	2	2	1	-	-	2	1	1	2	1	2
3	3	3	2	3	3	-	-	-	2	1	-	3	3	3
4	3	-	-	-	3	-	-	-	-	-	-	-	2	3
5	3	3	2	2	3	-	-	-	-	-	1	2	3	3

UNIT - I

Data Analytics Life cycle: Data Analytics Life cycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalise, Exploratory Data Analysis, Statistical Methods for Evaluation, ANOVA.

UNIT - II

Overview of Supervised Learning: Variable Types and Terminology, Two Simple Approaches to Prediction: Least Squares and Nearest Neighbors, Model Selection and Bias–Variance Tradeoff. **Association Analysis:** Association rules, Apriori algorithm, FP-Growth Technique

UNIT - III

Time Series Analysis: Overview of Time Series Analysis, ARIMA Model; **Text Analysis:** Text Analysis Steps, Stop Word Removal, Tokenization, Stemming and Lemmatization, Representing Text: Term-Document Matrix, Term Frequency--Inverse Document Frequency (TFIDF).

UNIT - IV

Introduction to Big Data: Defining big data, 4 V's of big data, Big data types, Analytics, Examples of big data, Big data and Data Risk, Big data technologies, benefits of big data, Crowd sourcing analytics; **Hadoop Distributed File Systems:** Architecture of Apache Hadoop HDFS and other File Systems, HDFS File Blocks, HDFS File Commands

UNIT - V

NoSQL Data Management: Types of NOSQL data bases, Benefits of NO SQL, **Map Reduce:** Introduction, Map reduce example, Job Tracker, Map Operations. **Data Stream Mining:** The stream data model, streaming applications, continuous query processing and optimization, Distributed query processing.

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Text Books:

1. EMC Education Services “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley Publishers, 2012.
2. Hastie, Trevor, et al., “The elements of statistical learning: Data Mining, Inference, and Prediction”, Vol. 2. No. 1. New York: Springer, 2009.
3. V.K. Jain,“Big Data & Hadoop”, Khanna Publishing House,2017.

Suggested Reading:

1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012
2. Mark Gardener, “Beginning R The statistical Programming Language”, Wiley, 2015.
3. Han, Kamber, and J Pei, “Data Mining Concepts and Techniques”, 3rd edition, Morgan Kaufman, 2012.
4. Big Data Black Book, DT Editorial Services, Wiley India
5. V.K. Jain, “Data Science & Analytics”, Khanna Publishing House Beginner’s Guide for Data Analysis using R Programming, Jeeva Jose, ISBN: 978-93-86173454.
6. Montgomery, Douglas C., and George C. Runger John, “Applied statistics and probability for engineers”, Wiley & Sons, 6th edition, 2013.

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16CSC 34 FREE AND OPEN SOURCE SOFTWARE

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Familiarity with Open Source Technologies
2. Study some FOSS Projects to under the principles, methodologies of FOSS.
3. Understand the policies, licensing procedures and ethics of FOSS.

Course Outcomes: On successful of this course student will be able to:
1. Differentiate between Open Source and Proprietary software and Licensing.
2. Recognize the applications, benefits and features of Open Source Technologies.
3. Understand and demonstrate Version Control System along with its commands.
4. Gain knowledge to start, manage open source projects.
5. Understand and practice the Open Source Ethics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	2	2	2	-	-	-	2	1	1	1	3
2	2	2	3	3	2	2	1	1	1	1	2	2	1	3
3	3	3	3	3	3	3	1	-	2	2	3	1	2	3
4	3	3	3	2	3	3	2	2	2	3	2	3	1	3
5	3	3	2	2	2	2	2	3	1	2	2	2	1	3

UNIT - I

Introduction to Open Source: Open Source, need and principles of OSS, Open Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT - II

Fault Tolerant Design: **Principles and Open Source Methodology**- History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT - III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, Libre Office.

UNIT - IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media

What Is A License, Creation of our own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT - V

Open Source Ethics: Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:

1. Kailash Vadera, Bhavyesh Gandhi, "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press, 2008

Suggested Reading:

1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills, 2009
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media, 2004.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media, 2005.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional,2004.
5. Clay Shirky and Michael Cusumano, "Perspectives on Free and Open Source Software", MIT press, 2005.

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16CSC 35 DISTRIBUTED AND CLOUD COMPUTING

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To present the principles underlying the function of distributed computing
2. To understand key mechanisms of remote execution
3. To impart the fundamentals and essentials of Cloud Computing.
4. To enable students explore cloud computing driven real time systems

Course Outcomes: On successful of this course student will be able to:

1. Understand the characteristics and models in distributed computing.
2. Define Cloud Computing and related concepts and describe the characteristics, advantages, risks and challenges associated with cloud computing.
3. Explain and characterize various cloud services and deployment models, virtualization techniques.
4. Illustrate the concepts of cloud storage and demonstrate their use.
5. Analyze various cloud programming models and apply them to solve problems

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	1	2	1	-	-	-	-	-	-	-	-
2	3	3	2	1	1	1	-	-	-	-	-	-	-	-
3	3	2	3	2	1	1	-	-	-	-	-	-	-	-
4	3	3	2	1	1	1	-	-	-	-	-	-	-	-
5	3	3	3	2	1	1	-	-	-	-	-	-	-	-

UNIT - I

Characterization of Distributed Systems: Introduction, Examples of distributed systems, Resource sharing and the web, Challenges, **System Models:** Introduction, Architectural models, Fundamental models, **Interprocess Communication:** Introduction, The API for the internet protocols, External data representation and marshalling, Client server communication, Group communication, Interprocess communication in UNIX

UNIT - II

Distributed objects and Remote Invocation: Introduction, Communication between distributed objects, Remote procedure call, Events and notifications, **Time and Global States:** Introduction, Clocks, events and process states, Synchronizing physical clocks, Logical time and logical clocks, Global states, distributed debugging, **Coordination and Agreement:** Introduction, Distributed mutual exclusion, Elections, Multicast communication, Consensus and related problems.

UNIT - III

Introduction to Cloud Computing: Scalable Computing Over the Internet, System Models for Distributed and Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, **Virtual Machines and Virtualization of Clusters and Data Centers:** Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT - IV

Cloud computing architecture over Virtualized Data Centers: Data-Center design and Interconnection networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, GAE, AWS, Azure, Inter-cloud Resource Management.

UNIT - V

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, **Common Standards in Cloud Computing:** The Open Cloud Consortium, the Distributed Management Task Force, Standards for Messaging, Internet Messaging Access Protocol (IMAP)

Text Books:

1. Colouris, Dollimore, Kindberg, “Distributed Systems concepts and Design”,5th Ed. Pearson Education, 2016.
2. Kai Hwang. Geoffrey C.Fox, Jack J. Dongarra, “Distributed and Cloud Computing From Parallel Processing to the Internet of Things”, Elsevier, 2012.

Suggested Readings:

1. Sunita Mahajan and Seema Shah,"Distributed Computing", Oxford University Press, 2013.
2. S.Ghosh, Chapman and Hall/CRC, ”Distributed Systems”, Taylor & Francis Group, 2010.
3. Pradeep K.Sinha, “Distributed Operating Systems Concepts and Design”, PHI,
4. Andrew S. Tanenbaum, Van Steen, “Distributed Systems”, Pearson Education, 2002.

16CSC 36 **MACHINE LEARNING**

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Pre-requisites: Linear Algebra and Probability theory basics

Course Objectives: The main objectives of this course are:
1. Understand the need and elements of Machine Learning
2. Study various machine learning techniques
3. Design solutions for real world problems using machine learning techniques

Course Outcomes: On successful of this course student will be able to:
1. Define the basic concepts related to Machine Learning
2. Recognize the underlying mathematical relationships within and across Machine Learning algorithms and their paradigms
3. Determine the various applications of machine learning
4. Model the problems using various machine learning techniques
5. Design and develop solutions to real world problems using Machine Learning Algorithms
6. Evaluate and interpret the results of the various machine learning techniques

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	3	-	-	-	-	-	-	-	3	3	2
2	3	3	1	3	-	-	-	-	-	-	-	3	3	2
3	3	3	1	3	-	-	-	-	-	-	-	3	3	2
4	3	3	1	3	-	-	-	-	-	-	-	3	3	2
5	3	3	1	3	3	-	-	-	-	-	-	3	3	2
6	3	3	1	3	3	-	-	-	-	-	-	3	3	2

UNIT - I

Introduction to Machine Learning: Introduction, Classic and Adaptive machines, learning types, deep learning, bio-inspired adaptive systems, Machine Learning and big data; **Elements of Machine Learning:** Data formats, Learnability, Statistical learning concepts, Class balancing, Elements of Information theory

UNIT - II

Feature Selection and Feature Engineering: Data sets, Creating training and test sets, managing categorical data, missing features, data scaling and normalization, Withering, Feature selection and filtering, PCA, Visualization of high-dimensional datasets; **Regression Algorithms**: Linear models for regression, Regression types, **Linear Classification Algorithms:** Linear classification, logistic regression, grid search, classification metrics, ROC curve

UNIT - III

Naïve Bayes and Discriminant Analysis: Bayes theorem, Naïve Bayes classifiers, Discriminant analysis; **Support Vector Machines**: Linear SVM, Kernel-based classification; **Decision Trees and Ensemble Learning**: Binary Decision trees, Introduction to Ensemble Learning-Random Forests, AdaBoost, Gradient Tree Boosting, Voting classifier

UNIT - IV

Clustering Fundamentals: Basics, k-NN, Gaussian mixture, K-means, Evaluation methods, DBSCAN, Spectral Clustering, Hierarchical Clustering; **Introduction to Neural Networks**: Introduction to deep learning, MLPs with Keras, deep learning model layers, introduction to Tensorflow

UNIT - V

Machine Learning Architectures: Data collection, Normalization and regularization, Dimensionality reduction, Data augmentation, Modeling/Grid Search/Cross-validation, Visualization, GPU support, introduction to distributed architectures, Scikit-learn tools for ML architectures, pipelines, Feature unions

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Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2nd Edition, Packt, 2018,
2. Tom Mitchel “Machine Learning”, Tata McGraW Hill, 2017

Suggested Reading:

1. Abhishek Vijavargia “Machine Learning using Python”, BPB Publications, 1st Edition, 2018
2. Reema Thareja “Python Programming”, Oxford Press, 2017
3. Yuxi Liu, “Python Machine Learning by Example”, 2nd Edition, PACT, 2017

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.htm
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.geeksforgeeks.org/machine-learning/

16CSC 37 DATA SCIENCE AND BIG DATA ANALYTICS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The main objectives of this course are:
1. To introduce practical exposure on basic data science techniques.
2. To develop the skills in using data science tools for solving data intensive problems.
3. To explore the fundamental concepts of big data analytics.

Course Outcomes: On successful of this course student will be able to:
1. Implement and apply data science algorithms to solve problems
2. Implement various the exploratory data analysis techniques to understand the data.
3. Work with big data platform and explore the big data analytics techniques business applications.
4. Design efficient algorithms for analyzing the data from large volumes.
5. Analyze the HADOOP and Map Reduce technologies associated with big data analytics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	2	2	2	1	-	-	2	1	1	2	1	2
2	3	1	2	2	2	1	-	-	2	1	1	2	1	2
3	3	1	1	-	-	2	-	-	-	-	-	1	-	-
4	3	3	2	2	3	-	-	-	-	-	1	2	3	3
5	3	3	2	2	3	-	-	-	-	-	1	2	3	3

List of Experiments:
1. Identification and Installation of required softwares/Technologies (Python/modules)
2. Important modules for statistical methods: Numpy, Scipy, Pandas etc.
3. Demonstration of Inferential Statistics-sampling, Hypothesis testing-Z/t tests
4. Demonstration of statistical methods Anova, Correlation and Chi-square
5. Important modules for Machine Learning: (ScikitLearn, Statsmodels, SciPy, NLTK etc.)
6. Demonstration of Sentiment analysis using NLTK
7. Time Series Forecasting with ARIMA model
8. Installation of Big data technologies and building a Hadoop cluster
9. Experiment for data loading from local machine to Hadoop
10. Demonstration of Map Reduce concept
11. Experiment for loading data from RDBMS to HDFS by using SQOOP
12. Demonstration of developing and handling a NOSQL database with HBase

Text Books:

1. Tom White, “Hadoop: The Definitive Guide: Storage and Analysis at Internet Scale”, 4th Edition, O'Reilly Publications, 2015.
2. Samir Madhavan, “Mastering Python for Data Science”, Packt Publishing, 2015.
3. Seema Acharya, Subhasinin Chellappan, “Big Data and Analytics”, Wiley publications.
4. Big Data, Black Book TM , Dream Tech Press, 2015 Edition

Professor and Head Department

16CSC 38 MACHINE LEARNING LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The main objectives of this course are:

1. Make use of Data sets in implementing the machine learning algorithms.
2. Implement the machine learning concepts and algorithms in any suitable language of choice.
3. Make use of real world data to implement machine learning models.

Course Outcomes: On Successful completion of this course, student will be able to:

1. Understand complexity of Machine Learning algorithms and their limitations.
2. Identify and understand modern tools that are useful in data analysis
3. Implement analyze Machine Learning algorithms
4. Use Keras and Tensorflow packages to implement the solutions
5. Design and develop solutions to real world problems using ML techniques
6. Evaluate and interpret the results of the various machine learning techniques

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	2	-	-	-	-	-	-	-	1	2	2
2	3	2	-	3	2	-	-	-	-	-	-	2	2	2
3	3	3	1	3	2	-	-	-	-	-	-	2	3	3
4	3	3	1	3	3	-	-	-	-	-	-	2	3	3
5	3	3	1	3	3	-	-	-	-	-	-	2	3	3
6	3	3	3	3	3	-	-	-	-	-	-	2	3	3

LIST OF EXPERIMENTS:

1. Identification and Installation of python environment towards the machine learning, installing python modules/Packages Import Scikitlearn, Keras and Tensorflows etc.
2. Demonstration of decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a News sample.
3. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate datasets.
4. Demonstration of Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
5. Demonstration of Bayesian network by considering standard dataset, by using Java/Python ML library classes/API.
6. Demonstration of Clustering algorithms - k-Means, K-Nearest Neighbor a, Agglomerative and DBSCAN to classify for the standard datasets. Print both correct and wrong predictions using Java/Python ML library classes can be used for this problem.
7. Experiment the non-parametric locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graph
8. Demonstration of SVM and use for character recognition task..
9. Build the decision tree classifier compare its performance with ensemble techniques like random forest. Demonstrate it with different decision trees.
10. Experiments on mobile Robots
11. Line, path following
12. Autonomous distance traversing
13. Autonomous distance traversing using GPS
14. Miniature self-driving car using machine learning

Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2017, Packt Publishing.

16CSC 39 **PROJECT SEMINARS**

Instruction 3 Hours per week
CIE 50 Marks
Credits 2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

Course Outcomes:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a Department Review Committee.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	--	--	--	2	--	--	--	--	--	2	2	2
2	2	--	--	--	--	2	--	--	--	--	--	2	3	3
3	2	--	--	--	--	--	--	2	--	2	--	--	--	--
4	--	--	--	--	1	--	--	2	--	3	--	--	--	--
5	--	--	--	--	1	--	--	2	--	3	--	--	--	--

Guidelines for the award of Marks: (**Max. Marks: 50**)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Review Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

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16CSE 10 DEEP LEARNING (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To learn Deep learning techniques and their applications.
2. To acquire the knowledge of neural network architectures, Deep learning methods and algorithms.
3. To understand CNN and RNN algorithms and their applications.

Course Outcomes: On successful of this course student will be able to:

1. Understand various learning models.
2. Design and develop various Neural Network Architectures.
3. Understand approximate reasoning using Convolution Neural Networks.
4. Analyze and design Deep learning algorithms in different applications.
5. Ability to apply CNN and RNN techniques to solve different applications.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	-	-	-	-	-	-	1	-	-	-	-
2	1	1	2	2	2	-	-	-	-	-	-	-	2	3
3	3	1	1	2	-	-	-	-	-	1	-	-	2	2
4	-	2	1	-	-	-	-	-	-	1	-	1	3	3
5	1	2	1	-	-	-	-	-	-	-	-	1	2	2

UNIT - I

Introduction: Historical Trends in Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm. Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feed forward Neural Networks, Representation Power of Feed forward Neural Networks

UNIT - II

Feed Forward Neural Networks, Back propagation, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMS Prop, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis Principal Component Analysis and its interpretations, Singular Value Decomposition

UNIT - III

Auto encoders : relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Contractive auto encoders, **Regularization:** Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization

UNIT - IV

Convolutional Neural Network: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types. LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Back propagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks

UNIT – V

Recurrent Neural Networks, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs, Encoder Decoder Models, Attention Mechanism, Attention over images

Text Books:

1. Goodfellow. I., Bengio. Y. and Courville. A., “Deep Learning”, MIT Press, 2016.

Suggested Reading:

1. Tom M. Mitchell, "Machine Learning", MacGraw Hill, 1997.
2. Stephen Marsland, "Machine Learning - An Algorithmic Perspective ", CRC Press, 2009.
3. LiMin Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill edition, 1994.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_cs41/

16CSE 11 DESIGN PATTERNS (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To understand the fundamental concepts of C++ and the design patterns,
2. User interfaces, standards of designing a document editor.
3. To understand the Structural Patterns, and the Behavioral pattern.
4. To learn about the dynamics of the design patterns.

Course Outcomes: On successful of this course student will be able to:
1. Apply formal notations of C++, design and develop pattern of user choice and accomplish UI and design an efficient editor.
2. Determine the prototypes, abstract factory to design and develop catalog pattern.
3. Apply the behavioral modeling principles design the behavioral pattern for a system.
4. Use design patterns for real world situations.
5. List consequences of applying each pattern.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	3	2	2	3	3	3	3	3	2	3
2	3	3	3	3	3	2	2	2	2	3	3	3	2	2
3	3	2	3	3	2	2	3	3	3	3	3	3	3	3
4	3	3	3	3	3	3	2	3	3	2	3	3	3	3
5	3	2	2	2	2	3	2	3	3	2	3	3	2	2

UNIT - I

Review of Formal Notations and Foundation Classes in C++: Class Diagram, Object Diagram, Interaction Diagram Examples, List, Iterator, List Iterator, Point, Rect, Coding in C++. **Introduction to Design Patterns:** Design Pattern Definition, Design Patterns in Small Talk MVC, Describing Design Patterns, Catalog of Design Patterns, Organizing The Catalog, Solving of Design Problems Using Design Patterns, Selection of A Design Pattern, Use of Design Patterns.

UNIT - II

Designing a Document Editor: A Case Study: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look and Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation.

UNIT - III

Design Patterns Catalog: Creational Patterns, Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

Structural Patterns-1: Adapter, Bridge, Composite, Decorator. Structural Patterns-2 and Behavioral Patterns-1: Structural Patterns: Façade, Flyweight, Proxy, Discuss of Structural Patterns.

UNIT - IV

Behavioral Patterns: Chain of Responsibility Command, Interpreter. **Behavioral Patterns-2:**Iterator, Mediator, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns.

UNIT - V

Behavioral Patterns-3: State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns, Expectations from Design Patterns.

Text Books:

1. Gamma, Belm, Johnson, “Design Patterns: Elements of Reusable Object Oriented Software”, 1995, Pearson Education ISBN:10:0201633612.
2. Eric Freeman, “Head First Design Patterns”, Oreilly-SPD,ISBN:10:0596007124.

Suggested Reading:

1. Cooper, “Java Design Patterns”, Pearson Education, ISBN:6201-48539-7.
2. Horstmann, “Object Oriented Design and Patterns”, Wiley, ISBN:10:0471744875.

Online Resources:
1. shop.oreilly.com/product/9780596007126.do
2. ww.amazon.com/Design-Patterns-Elements.../dp/0201633612

16CSE 12 NATURE INSPIRED ALGORITHM (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Design and Analysis of Algorithms

Course Objectives: The main objectives of this course are:
1. Understand the fundamentals of nature inspired techniques which influence computing
2. Study the Swarm Intelligence and Immuno computing techniques
3. Familiarize the DNA Computing

Course Outcomes: On successful of this course student will be able to:
1. Understand The basics Natural systems
2. Learn the concepts of Natural systems and its applications
3. Understand different basic Natural systems functions(operations)
4. Understand Natural design considerations
5. Apply to real world problems

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	-	3	-	-	-	-	-	-	--	-	-	-	-
4	-	3	3	-	-	-	-	-	-	-	-	-	2	-
5	-	3	2	-	-	-	-	-	-	-	--	-	2	-

UNIT - I

Introduction: From Nature to Nature Computing , Philosophy , Three Branches: A Brief Overview, Individuals, Entities and agents - Parallelism and Distributivity Interactivity ,Adaptation- Feedback-Self-Organization-Complexity, Emergence and ,Bottom-up Vs Top-Down- Determination, Chaos and Fractals.

UNIT - II

Computing Inspired by Nature: Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms , Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming

UNIT - III

Swarm Intelligence: Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO)

UNIT - IV

Immuno computing: Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding , Immune Network Theory- Danger Theory, Evaluation Interaction- Immune Algorithms , Introduction – Genetic algorithms , Bone Marrow Models , Forest's Algorithm**,** Artificial Immune Networks

UNIT - V

Computing With New Natural Materials: DNA Computing: Motivation, DNA Molecule , Adleman's experiment , Test tube programming language, Universal DNA Computers, PAM Model , Splicing Systems , Lipton's Solution to SAT Problem , Scope of DNA Computing, From Classical to DNA Computing

Text Books:
1. Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007
2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008

Suggested Reading:
1. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
2. Marco Dorrigo, Thomas Stutzle, "Ant Colony Optimization", PHI,2005

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16CSE 13 SYSTEM AND NETWORK ADMINISTRATION (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System Concepts, Computer networking basics

Course Objectives: The main objectives of this course are:

1. Understand the basic operation of system and networking.
2. Familiarize the students with system and network administration.
3. Analyze the system and network performance, issues.

Course Outcomes: On successful of this course student will be able to:

1. Understand the basics of systems administration and networking.
2. Identify and apply various system network administration tools/commands.
3. Configure various services like mail, ftp, web hosting, security.
4. Analyze various system and network performance and issues.
5. Troubleshoot various system and network services.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	2	1	1	-	-	1	2	1	2	3	2
2	3	3	3	3	3	2	1	-	2	2	2	3	3	3
3	2	2	2	2	3	1	1	-	2	2	1	2	2	2
4	2	3	3	2	2	1	1	-	1	3	2	2	3	2
5	2	3	2	3	2	-	-	-	1	2	1	2	2	1

UNIT - I

Networking Overview: Protocol standards, Reference Models (ISO-OSI, TCP/IP), Networking basics of Windows and Linux, switching and routing basics

Server Administration Basics: Server and Client Installation, boot process and startup Services: Xinetd, Managing user and group accounts, File Systems and Quota Management , Job Scheduling with *cron, crontab, anacron* and system log analysis, Process controlling and management, online server updation process.

UNIT - II

Network Configuration Basics: IPv4 and IPv6 addressing, Network Interface Configuration, Diagnosing Network startup issues, Linux and Microsoft, Firewall configuration, Network troubleshooting commands

Dynamic Host Configuration Protocol (DHCP), DHCP Principle, DHCP Server Configuration, DHCP Options, Scope, Reservation and Relaying and troubleshooting

UNIT - III

Name Server and Configuration: DNS principles and Operations, Basic Name Server and Client Configuration, Caching Only name server, Primary and Slave Name Server, DNS Zone Transfers, dynamic updates, delegation, DNS Server Security, Troubleshooting

Web and Proxy Server Configuration: HTTP Server Configuration Basics, Virtual Hosting, HTTP Caching, Proxy Caching Server Configuration, Proxy ACL, Proxy-Authentication Mechanisms, Troubleshooting

UNIT - IV

FTP, File and Print Server: General Samba Configuration, SAMBA SWAT, NFS and NFS Client Configuration, CUPS configuration basics, FTP Principles, Anonymous FTP Server, Troubleshooting

Mail Server basics: SMTP, POP and IMAP principles, SMTP Relaying Principles, Mail Domain Administration, Basic Mail Server Configuration, SPAM control and Filtering

UNIT - V

Remote Administration and Management: Router Configuration, webmin/usermin, Team Viewer, Telnet, SSH, SCP, Rsync

Text Books

1. Thomas A. Limoncelli, Christina J. Hogan , Strata R. Chalup,"The Practice of System and Network Administration", Second Edition, 2007
2. Roderick W. Smith, "Advanced Linux Networking", Addison-Wesley Professional (Pearson Education), 2002.
3. Tony Bautts, Terry Dawson, Gregor N. Purdy, "Linux Network Administrator's Guide", O'Reilly, Third Edition, 2005

Online Resources:

1. https://nptel.ac.in/courses/106106157/25
2. https://onlinecourses.nptel.ac.in/noc17_ee15/preview

16CEO 02 DISASTER MITIGATION AND MANAGEMENTELECTIVE-V (OE1)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters.
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases in a disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions.

Course Outcomes: On Successful completion of this course, student will be able to

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels.
2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management.
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same.
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2	2	2	1	2	2	2	1	1	
2	1	1	2	2	2	3	3	1	2	1	1	1		2
3	2	2	2	2	2	2	3	2	1	1	2	1	1	
4	2	2	2	2	3	2	1	1	1	1	1	1		2
5	2	1	2	1	2	3	1	2	2	2	2	1	2	

UNIT - I

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT - II

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT - III

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storied buildings.

UNIT - IV

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT - V

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni, "Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh, "Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs. Government of India, "National disaster management plan, Part I and II".
2. K. K. Ghosh," Disaster Management", APH Publishing Corporation, 2006.
3. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

Online Resources:

1. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)

16MEO 01 **ENTREPRENEURSHIPELECTIVE-V (OE1)**

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Course Outcomes: On Successful completion of this course, student will be able to

1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	1	2	1	2	2	2	2	2	2	2	1
2	2	2	2	2	2	2	-	1	2	2	2	1
3	2	2	2	2	2	2	1	1	2	2	2	1
4	3	3	1	2	2	-	-	-	1	1	3	2
5	1	1	1	1	2	-	1	1	1	1	2	2

UNIT - I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT - II

Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT - III

Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT - IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT - V

Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, “Dynamics of Entrepreneurial Development and Management”, Himalaya Publishing House, 1997.
2. Prasanna Chandra, “Project-Planning, Analysis, Selection, Implementation and Review”, Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, “Entrepreneurial Development”, S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, “Entrepreneurship”, 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, “First Things First”, Simon and Schuster Publication, 1994.
3. Sudha G.S., “Organizational Behavior”, National Publishing House, 1996.

16MEO 06 RESEARCH METHODOLOGIES ELECTIVE-V (OE1)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To make the students to formulate the research problem
2. To identify various sources for literature review and data collection.
3. To prepare the research design
4. To equip the students with good methods to analyze the collected data
5. To explain how to interpret the results and report writing

Course Outcomes: On successful of this course student will be able to:

1. Define research problem
2. Review and asses the quality of literature from various sources.
3. Understand and develop various research designs.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Improve the style and format of writing a report for technical paper/ Journal report

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	-	1	-	-	1	2	2	2	1	2
2	-	2	1	2	1	-	-	-	-	2	2	2	-	2
3	1	2	3	2	2	1	-	-	1	2	-	1	1	2
4	2	2	-	3	2	-	-	-	-	2	1	1	2	2
5	-	1	-	-	1	1	-	-	1	3	-	2	-	1

UNIT – I

Research Methodology: Objectives and Motivation of Research, Types of Research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research Approaches, Significance of Research, Research Methods verses Methodology, Research process, Criteria of Good Research, Problems Encountered by Researchers in India, Technique involved in defining a problem.

UNIT–II

Literature Survey: Importance of Literature Survey, Sources of Information-primary, secondary, tertiary, Assessment of Quality of Journals and Articles, Information through Internet.

UNIT – III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Steps in sample design

UNIT – IV

Data Collection: Collection of primary data, Secondary data, Measures of central tendency-mean, mode, median, Measures of dispersion- Range, Mean deviation, Standard deviation, Measures of asymmetry (skewness), Important parametric tests -z, t, F, Chi-Square, ANOVA significance

UNIT – V

Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation- Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

Text Books:

1. C.R Kothari, “Research Methodology, Methods & Technique”, New Age International Publishers, 2004.
2. R. Ganesan, “Research Methodology for Engineers”, MJP Publishers, 2011

Suggested Reading:

1. Vijay Upagade and Aravind Shende, “Research Methodology”, S. Chand & Company Ltd., 2009
2. G. Nageswara Rao, “Research Methodology and Quantitative methods”, BS Publications, 2012.
3. Ratan Khananabis and Suvasis Saha, “Research Methodology”, Universities Press, Hyderabad, 2015

16EGO 02

GENDER SENSITIZATION
ELECTIVE-V (OE1)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course Outcomes: On successful of this course student will be able to:

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	1	-	1	-	-	-	1	1	-
2	-	-	-	-	-	-	-	1	1	1	-	1	1	-
3	-	-	-	-	-	1	-	1	1	1	-	1	1	-
4	-	-	-	-	-	1	-	1	1	1	-	1	1	-
5	-	-	-	-	-	1	-	1	1	1	-	1	1	-

UNIT – I

Understanding Gender: Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1) **Socialization:** Making Women, Making Men (*Towards a World of Equals*: Unit -2)
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II

Gender and Biology: Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit - 4) Declining Sex Ratio. Demographic Consequences. **Gender Spectrum:** Beyond the Binary (*Towards a World of Equals*: Unit -10) Two or Many? Struggles with Discrimination.

UNIT – III

Gender and Labour: Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3) "My Mother doesn't Work." "Share the Load." **Women's Work**: Its Politics and Economics (*Towards a World of Equals*: Unit -7) Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV

Issues of Violence: Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6) Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu*". **Domestic Violence:** Speaking Out (*Towards a World of Equals*: Unit -8) Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice. Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11) Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V

Gender: Co – Existence : Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12) Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

Text Books:

1. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, 2015.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. **"I Fought For My Life…and Won."** Available online at:
3. http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Online Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTION AND EXAMINATION
VIII-Semester of B.E under CBCS
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-VIII

Sl.No	Syllabus Ref. No	SUBJECT	Scheme of Instruction		Scheme of Examination			Credits
			Periods per Week		Duration Credits of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16CSE XX	Elective-VI	3	-	3	30	70	3
2	16CSE XX	Elective-VII	3	-	3	30	70	3
3	6MT/ME/PY OXX	Elective-VIII	3	-	3	30	70	3
PRACTICALS								
7	16CSC 40	Seminar	-	3	3	50	-	2
8	16CSC 41	Project	-	6	3	50	100	6
		TOTAL	**9**	**9**		**190**	**310**	**17**

ELECTIVE-VI		ELECTIVE-VII	
16CSE 14	Cyber Security	16CSE 18	Bioinformatics
16CSE 15	Optimization Techniques	16CSE 19	Human Computer Interaction
16CSE 16	Natural Language Processing	16CSE 20	Social Networking and its Impact
16CSE 17	Virtual Reality	16CSE 21	Blockchain Technology

ELECTIVE-VIII (OE2)	
16MTO 04	Quantum Computing
16MEO 02	Robotics
16MEO 04	Intellectual Property Rights
16PYO 01	History of Science and Technology

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Assessment Procedure				
Course (in terms of credits)	**Continuous Internal Evaluation (Marks)**	**Semester end Examination (Marks)**	**Remarks**	**Duration of Semester End Examination**
Three(3)Credits/ Four(4)credits	30*	70**	Theory Course/ Engg . Graphics	3 Hours
Two(2) Credits	25	50	Lab Course/Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
One(1) Credit	50	-	Mini Project	-

* Out of 30 CIE, 10 marks are allotted for slip-tests (Three slip tests will be conducted, each of ten marks, and average of best two is considered) and the remaining 20 marks are based on the average of two tests, weightage for each test is 20 marks.

** The question paper will be in two parts, Part-A and Part-B. Part A is compulsory and contains short answer questions covering the entire syllabus, and carries 20 marks. Part-B carries 50 marks and covers all the units of the syllabus (student has to answer five out of seven questions).

Note: A course that has CIE but no SEE as per scheme is treated as PASS/FAIL for which pass marks are **50%** of CIE.

A candidate has earned the credits of a particular course, if he/she secures not less than the minimum marks/ grade as prescribed. Minimum pass marks in the SEE plus CIE shall be **40%** for theory courses/subjects and **50%** for lab courses /Mini Project// Project.

16CSC 40 **SEMINAR**

Instruction	3Hours per week
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:
1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Course Outcomes: On successful of this course **s**tudent will be able to:

1. To study current emerging areas of professional interest.
2. To identify promising new directions of various cutting edge technologies
3. To analyze and make use of appropriate methodologies .
4. To pursue their interest in Computer Science & Engg., through design, research, theoretical and experimental approach.
5. To effectively use modern technologies for presentation before an evaluation committee
6. To acquire skills in preparing detailed report.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2	1	-	-	-	-	-	-	3	3
2	2	2	2	2	2	1	-	-	-		-	-	2	3
3	2	2	1	2	2	-	-	-	-	-	-	-	2	2
4	2	2	2	2	2	-	-	-	-	-	-	-	3	3
5	2	2	2	2	3	1	-	-	3	2	-	-	3	3
6	2	2	2	2	2	1	-	-	2	3	-	-	-	-

Each student is required to:
1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.
4. Seminars are to be scheduled from **3rd week to the last week** of the semester and any change in schedule shall be discouraged.
5. For the award of Sessional marks students are **judged by three (3) faculty** members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
SNo	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

16CSC 41 **PROJECT**

Instruction	6 Hours per week
CIE	50 Marks
SEE	100 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Department Review Committee.

Course Outcomes: By the end of course, students will be able to:

1. Demonstrate a sound technical knowledge of their selected topic
2. Design engineering solutions to complex problems utilizing a systematic approach
3. Conduct investigations by using research-based knowledge and methods to provide valid conclusions
4. Create/select/use modern tools for the modeling, prediction and understanding the limitation of complex engineering solutions
5. Communicate with engineers and the community at large in written and oral forms
6. Demonstrate the knowledge, skills and attitudes of a professional engineer

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	--	--	--	--	--	--	--	--	--	--	--	2	2
2	2	--	3	--	--	--	--	--	--	--	--	--	2	2
3	2	--	--	3	--	--	--	--	--	--	--	--	--	--
4	2	--	--	--	3	--	--	--	--	--	--	--	--	3
5	--	--	--	--	--	--	--	--	--	3	--	--	--	1
6	2	2	--	--	2	2	--	1	3	--	2	2	--	--

Guidelines for the award of marks in CIE: (Max. Marks: 50)

CIE (Continuous Internal Evaluation) Max. Marks: 50

Evaluation by	Max .Marks	luation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Max. Marks: 100

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

16CSE 14 **` (ELECTIVE-VI)**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives: The objectives of this course are

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Course Outcomes: On Successful completion of this course, student will be able to

1. Discuss different types of cybercrimes and analyze legal frameworks to deal with these cybercrimes.
2. Describe Tools used in cybercrimes and laws governing cyberspace.
3. Analyze and resolve cyber security issues.
4. Recognize the importance of digital evidence in prosecution.
5. Analyze the commercial activities in the event of significant information security incidents in the Organization.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	1	3	1	1	1	-	-	2	-	1
2	3	2	2	3	3	2	1	2	2	1	-	2	-	2
3	2	3	1	3	3	3	1	2	3	2	2	3	-	1
4	2	2	1	3	3	3	1	2	3	2	1	2	-	1
5	2	3	2	3	3	2	1	2	3	2	2	3	-	1

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector; **Tools and Methods Used in Cybercrime:** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives**:** Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Sunit Belpre and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, "Incident Response and computer forensics", Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, “Cyber Security and Cyber Laws”, Paperback – 2018.
2. Mark F Grady, Fransesco Parisi, “The Law and Economics of Cyber Security”, Cambridge university press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

16CSE 15 OPTIMIZATION TECHNIQUES (ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To introduce fundamentals of Operation Research and Linear Programming
2. To impart knowledge on various methods to solve balanced & unbalanced transportation problems
3. To learn the working solutions of Sequencing Problems and Assignment Problems
4. To study the categories of Integer Programming Problems and Linear Programming Approach for Game Theory
5. To obtain familiarity on Construction of Network and obtaining of Critical Path

Course Outcomes: On successful of this course student will be able to:

1. Calculate the optimum values for given objective function by LPP
2. Solve the solution for maximise the profit with minimum cost by Transportation problem.
3. Determine the optimum feasible solution for sequencing the Jobs
4. Solve and analyze problems on Integer programming and other mathematical programming algorithms.
5. Learn how to deal with real world scenarios of Network analysis, Project Management, for their optimal solutions.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	-	-	-	-	1	-	-	2	-	2	-
2	2	2	2	-	-	-	-	1	-	-	2	-	2	-
3	2	2	2	-	-	-	-	-	-	-	2	-	2	-
4	2	2	2	-	-	-	-	-	-	-	-	-	2	-
5	2	2	2	-	-	-	-	2	1	1	-	-	2	-

UNIT - I

Operation Research: Introduction, Models, Areas of Application. Linear Programming (L.P.) - Mathematical Formulation of L.P. problem, Graphical Method, Simplex Method – Concept of slack, surplus & artificial variables, Manual solutions of LPP, Minimization & Maximization Problems, Special Cases – (i) Alternative optima (ii) Unbounded solutions & (iii) Infeasible solutions to be shown graphically & also by simplex method.

UNIT - II

Definition of the transportation model, Balanced / Unbalanced, Minimization / Maximization, Determination of the initial basic feasible solution using (i) North-West Corner Rule (ii) Least cost method & (iii) Vogel's approximation method for balanced & unbalanced transportation problems. Optimality Test & obtaining of optimal solution (Considering per unit transportation cost)

UNIT - III

Assignment model, Assignment Problem Formulation, Hungarian method for optimal solution, Solving unbalanced problem, Traveling salesman problem and assignment problem, Sequencing models, Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines – Processing n Jobs through m Machines.

UNIT - IV

Integer Programming Problem: Introduction, Types of Integer Programming Problems, Gomory's All-IPP Method, All IPP Algorithm, Branch and Bound Technique

Game Theory: Introduction, Game with Pure Strategies, Game with Mixed Strategies, Dominance Property, Graphical Method for 2 X n or m x 2 Games, Linear Programming Approach for Game Theory.

UNIT - V

Construction of Network – Rules & Precautions, C.P.M. & P.E.R.T. Networks, Obtaining of Critical Path, Time estimates for activities, Probability of completion of project, Determination of floats (total, free, independent & interfering)

Text Books:

1. Kanti Swarup, P. K. Gupta, Man Mohan, "Operations Research", Sultan Chand Publications.
2. R. Pannerselvam, "Operations Research", PHI

16CSE 16 NATURAL LANGUAGE PROCESSING (ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To learn the fundamentals of natural language processing.
2. To understand the various Parsing techniques NLP.
3. To understand the role of semantics of sentences and pragmatics and apply the NLP techniques to IR applications.

Course Outcomes: On successful of this course student will be able to:

1. Define the basic concepts of grammars languages and applications of Natural Language processing --
2. Discuss about the language modelling techniques
3. Identify the basic words, parsers and various levels in processing of natural language.-
4. Explain the various semantics discourse and pragmatic levels of NLP
5. Analyze Natural language Generation and apply machine translation.
6. Implement levels of NLP system using the Components or lexical resources to demonstrate Morphology / syntax of a language.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	-	1	-	-	-	-	-	-	-	3		
2	3	2	1	2	3	-	-	-	-	-	-	1	1	3
3	3	2	1	1	-	-	-	-	-	-	-	1	-	-
4	3	3	1	2	-	-	-	-	-	-	-	1	-	-
5	3	2	1	2	2	-	-	-	-	-	-	2	-	-
6	3	3	1	2	-	-	-	-	-	-	-	2	-	-

UNIT - I

Overview and Language Modeling

Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval. **Language Modeling:** Introduction-Various Grammar-based Language Models-Statistical Language Model.

UNIT - II

Word Level and Syntactic Analysis

Word Level Analysis: Introduction Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. **Parsing:** Constituency Parsing - Probabilistic Parsing.

UNIT - III

Semantic Analysis and Discourse Processing

Semantic Analysis: Introduction- Meaning Representation-Lexical Semantics Ambiguity-Word Sense Disambiguation. **Discourse Processing:** Introduction- cohesion-Reference Resolution Discourse Coherence and Structure.

UNIT - IV

Natural Language Generation and Machine Translation

Natural Language Generation: Introduction-Architecture of NLG Systems Generation Tasks and Representations-Application of NLG. Problems in Machine Translation, Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages.

UNIT - V

Applications and Lexical Resources: Information Extraction, Automatic Text Categorization and Text Summarization, Question-Answering System. LEXICAL RESOURCES: Introduction - WordNet- FrameNet – Stemmers - POS Tagger, Research Corpora, NLTK.

Text Books:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

Suggested Reading:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, Prentice Hall, 2nd Edition, 2008.
2. James Allen, Bejamin/cummings, “Natural Language Understanding”, 2nd edition, 1995.

16CSE 17 **VIRTUAL REALITIES (ELECTIVE-VI)**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Provide detailed understanding of the concepts of Virtual Reality and applications
2. Understand geometric modeling and virtual environment
3. Prepare the students to develop Virtual Reality applications

Course Outcomes: On successful of this course student will be able to:
1. Understand the fundamental concepts of Virtual Reality
2. Identify the applications of Virtual Reality
3. Know the virtual hardware and software
4. Familiarize with various VR technologies
5. Design and Develop Virtual Reality based applications

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	-	-	1	-	-	-	-	-	-	-	1	1
2	1	2	2	2	1	-	-	-	-	-	-	-	1	1
3	2	2	2	2	1	-	-	-	-	-	-	-	1	1
4	1	1	1	1	2	-	-	-	-	-	-	-	1	2
5	2	2	3	2	3	1	-	-	-	-	-	-	1	1

UNIT - I

Introduction to Virtual Reality- Introduction, Computer Graphics, real time computer graphics, flight simulation, virtual environment requirement, benefits of virtual reality, historical development of VR, scientific landmark; **3D Computer Graphics:** Introduction, virtual world space, positioning the virtual observer, perspective projection, human vision, stereo perspective projection, 3D clipping, color theory, simple 3D modeling, illumination models, reflection models, shading algorithms, radiosity, Hidden surface removal, realism0stereographic image

UNIT - II

Geometric Modeling: Introduction, 2d to 3D, 3D space curves, 3D boundary representation, **Geometric Transformations:** Introduction, frames of reference, modeling transformations, instances, picking, flying, scaling the VE, collision detection; **Generic VR system**: Introduction, virtual environment, computer environment, VR technology, Model of interaction, VR systems

UNIT - III

Virtual Environment: Introduction, dynamics of numbers, linear and non-linear interpolation, animation of objects, linear and non-linear translation, shape and object in between, free from deformation, particle system, **Physical Simulation:** Introduction, objects falling in a gravitational field, rotarotating wheels, elastic collisions, projectivities, simple pendulum, springs, flight dynamics of an aircraft

UNIT - IV

VR Hardware and Software: Human factors-eys, ear and somatic senses; **VR Hardware**: Introduction, sensor hardware, hed-coupled displays, acoustic hardware, integrated VR system; **VR Software:** Modeling virtual world, physical simulation, VR toolkits, introduction to VRML

UNIT - V

VR Applications: Engineering, Entertainment, Science, Training, **Future:** Virtual environment, modes of interaction

Text Books:

1. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007
2. Anad R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi

Suggested Reading:

1. Adams, "Visualization of Virtual Reality", Tata McGraw Hill, 2000
2. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2006
3. William R Sherman, Alan B Craig, "Understanding Virtual Reality: Interface, Applications and Design", Morgan Kaufman, 2008

Online Resources:
1. www.vresources.org
2. www.vrac.iastate.edu
3. www.w3.org/MarkUp/VRM

16CSE 18 BIOINFORMATICS (ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Understand the basic concepts, search and visualize information.
2. Learn various bioinformatics algorithms.
3. Understand various data mining and pattern matching techniques.

Course Outcomes: On successful of this course student will be able to:

1. Understand the basics concepts of Bioinformatics and its significance in Biological data analysis**.**
2. Represent biological information using various algorithms
3. Apply data mining and pattern matching techniques
4. Choose and apply appropriate statistical methods for solving complex biological problems.
5. Reviewing the various bioinformatics tools and their Applications.
6. Design real-time solutions by using basic principles of biology, Computer Science and mathematics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	2	3	3	3	3	2	2	2	2	1	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	2	2	3	3	3	3	3	2	2	3	3	3
4	3	3	2	3	2	2	2	2	2	2	2	3	3	2
5	3	2	2	3	3	2	2	3	3	2	3	3	2	2
6	2	2	3	3	3	3	3	3	3	3	3	3	2	2

UNIT - I

Introduction to Bio-Linux and Networks: Introduction to networking in Linux, Basic commands in linux-pwd, awk, grep, sed, ls, remote login, ftp, wget, different shells such as c shell, Network basics and tools, File Transfer protocol in Linux, Network File System, Domain Name Services, Networks, Geographical Scope, Communication Models, Transmissions Technology.

UNIT - II

Bio-Basics: Kingdom of life-Bacteria, virus, plant, animal-Central dogma-chromosome-Prokaryotic genes and eukaryotic genes, Gene expression,-Genetic code-Protein synthesis basics, protein structures.

UNIT - III

Pattern matching: Pair-wise sequence alignment, Local versus global alignment, BLAST and its versions, Multiple sequence alignment, Dot Matrix analysis, Substitution matrices, Dynamic Programming, Word methods, Bayesian methods, Multiple sequence alignment, Dynamic Programming, Progressive strategies ,Iterative strategies, Tools, Nucleotide Pattern Matching, Polypeptide pattern matching, Utilities, Sequence Databases protein structure determination- abinito-threading- homology modeling methods.

UNIT IV

Bio-Statistics: Statistical concepts, Imperfect Data, Randomness, Variability, Approximation, Interface Noise, Assumptions, Sampling and Distributions, Hypothesis Testing, Quantifying Randomness, Data Analysis, Tool selection statistics of Alignment, Clustering and Classification.

UNIT V

Biodatabases and Data Mining: Biodatabase- basics of PHP, MySQL or MongoDB, HTML, CSS, java scripting Basics or Wordpress, Data Mining: Methods, Selection and Sampling, Preprocessing and Cleaning, Transformation and Reduction, Data Mining Methods, Evaluation, Visualization, Designing new queries, Pattern Recognition and Discovery, Machine Learning ,Text Mining , Tools.

Text Books:

1. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education, 2015.
2. T.K.Attwood and D.J. Perry Smith, “Introduction to Bio Informatics, Longman Essen, 1999.
3. JinXiong, “Essential Bio Informatics”, Cambridge University Press,2006.

Suggested Readings:

1. Neil C.Jones, PaveA. Pevzner, ”An Introduction to, Bioinformatics Algorithms (Computational Molecular Biology)”, MIT Press 2004.

Online Resources:

1. https://nptel.ac.in/courses/102106065/
2. https://www.ncbi.nlm.nih.gov/

16CSE 19

HUMAN COMPUTER INTERACTION (ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Learn the foundations of Human Computer Interaction.
2. Familiarize with the design technologies for computer interaction.
3. Learn the design strategies, guidelines, models and theories for developing a user friendly interface.

Course Outcomes: On successful of this course student will be able to:
1. Understand the structure of models and theories of human computer interaction.
2. Understand the vision of a computer user.
3. Understand the recognition and remembrance limitations of a computer user.
4. Understand the design rules and design process.
5. Apply the models and theories of human computer interaction to real-time problems

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	-	-	-	-	-	1	-	1		
2	3	1	2	1	1	-	-	-	-	1	-	1		
3	3	1	2	1	1	2	-	-	-	1	-	1		
4	3	1	1	1	1	2	1	-	1	1	-	1		
5	3	1	1	1	1	2	1	-	1	1	-	1		

UNIT - I
Foundations: The human, The computer, The Interaction, Paradigms. Introduction, Our perception is biased, Our vision is optimized to see structure

UNIT - II
We Seek and Use Visual Structure, Our Color Vision is Limited, Our Peripheral Vision is Poor, Reading is Unnatural, Our Attention is Limited; Our Memory is Imperfect, Limits on Attention Shape Our Thought and Action

UNIT - III
Recognition is Easy; Recall is Hard, Problem Solving and Calculation are Hard, Many Factors Affect Learning, Human Decision Making is Rarely Rational

UNIT - IV
Our Hand–Eye Coordination Follows Laws, We Have Time Requirements, Well-known User-Interface Design Rules, Design Process**:** Interaction design basics, HCI in the software process, Design rules

UNIT - V
Models and Theories: Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models, Task analysis, Hypertext, multimedia and the World Wide Web.

Text books:

1. Jeff Johnson, “Designing with the Mind in Mind – Simple Guide to Understanding”, 2nd edition, Elsevier Inc., 2010.
2. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, “Human Computer Interaction”, 3rd edition, Pearson Education Limited, 2004.

Suggested Reading:

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, “Designing the User Interface”, 5th Edition, Pearson Education Limited, 2013.
2. John Haugeland, “Mind Design II”, 2nd Edition, Revised and enlarged edition, The MIT Press, 1997.

16CSE 20 SOCIAL NETWORKING AND ITS IMPACT(ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Familiarize the students with social networks and their representation.
2. Understand the impact of social networks on society.
3. Study and Analyze the social network search models.

Course Outcomes: On successful of this course student will be able to:

1. Understand a broad range of social networks concepts and theories.
2. Appreciate how network analysis can contribute to increasing knowledge about diverse aspects of society.
3. Analyze social network links and web search.
4. Communicate the analysis results and impact of social networks.
5. Differentiate between centralized and decentralized search models.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	1	1	-	1	1	-	1	1	-
CO2	3	2	1	-	-	-	-	-	-		-	-	1	1
CO3	2	2	2	1	-	1	-	-	-	1	-	-	1	1
CO4	2	2	1	2	1	1	-	-	-	-	-	-	1	1
CO5	3	2	2	1	-	-	-	-	-	1	-	-	1	1

UNIT - I

Introduction: to Social Networks: Introduction to Social Networks, Challenges, Google page rank, Searching on network, link prediction, contagious, marketing on social networks; **Graphs**: Basic definitions, paths and connectivity, distance and breadth first search, network datasets. **Strong and Weak Ties**: Triadic closure, strength of weak Ties, Tie strength and network structure in large-scale data, Tie strength, social media and passive engagement, closure, structured holes and social capital.

UNIT - II

Networks in surrounding contexts: Homophily, selection and social influence, affiliation, tracking link formation in online data, spatial model of segregation. **Positive and negative relationships**: Structural balance, characterizing the structure of balanced networks, applications of structured balance.

UNIT - III

Link analysis and Web search: Searching the web, ranking, link analysis using hubs and authorities, page rank, link analysis in modern web search, applications beyond web.

Cascading behavior in networks: Diffusion in networks, modeling diffusion, cascades and clusters, diffusion, thresholds and role of weak Ties, extensions of cascade model, knowledge, thresholds and collective actions

UNIT - IV

Power Laws and Rich-get-Richer Phenomena: Popularity as a network phenomenon, power laws, rich-get-richer models, unpredictability of rich-get-richer effects, effects of search tools and recommender systems, analysis of rich-get-richer processes. Pseudo core- how to go viral on the web

UNIT - V

Small world phenomenon: Six degrees of separation, structured and randomness, decentralized search, modeling the process of decentralization search, empirical analysis and generalized models, core-peiphery structures and difficulties in decentralized search, analysis of decentralized search.

Text Books:

1. David Easley, Jon Kleinberg, “Networks, Crowds and Markets”, Cambridge Press, 2010 (available for free download).
2. Mathew O Jackson “Social and Economic Networks”, Princeton University, 2010.

Online Resources:

1. https://nptel.ac.in/downloads/106106169/

16CSE 21 BLOCKCHAIN TECHNOLOGY (ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Computer Networks, Network Security

Course Objectives: The main objectives of this course are:
1. Understand the basic concepts and architecture of blockchain
2. Interpret working of Hyperledger Fabric
3. Applications of blockchain in various domains

Course Outcomes: On successful of this course student will be able to:
1. State the basic concepts of blockchain
2. Understand the list of Consensus
3. Demonstrate and Interpret working of Hyperledger Fabric, SDK composer tool
4. Demonstrate the supply chain.
5. Apply to various use cases from different domains

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
2	3	3	2	1	-	-	-	-	-	-	-	-	-	-
3	3	3	1	2	1	-	-	-	-	-	-	-	-	-
4	3	2	1	-	-	-	-	-	-	-	-	-	-	-
5	3	3	1	-	-	-	-	-	-	-	-	-	-	-

UNIT - I

Introduction: History: Digital Money to Distributed Ledgers - Design Primitives: Protocols, Security, Consensus, Permissions, Privacy-: Blockchain Architecture and Design-Basic crypto primitives: Hash, Signature-Hashchain to Blockchain-Basic consensus mechanisms

UNIT - II

Consensus: Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Blockchain consensus protocols**:** Permissioned Blockchains-Design goals-Consensus protocols for Permissioned Blockchains

UNIT - III

Hyperledger Fabric: Decomposing the consensus process-Hyperledger fabric components-Chaincode Design and Implementation: Hyperledger Fabric II:-Beyond Chaincode: fabric SDK and Front End-Hyperledger composer tool

UNIT - IV

Use Case I: Blockchain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital markets-Insurance- **Use case II:** Blockchain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting

UNIT - V

Use Case III: Blockchain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems : Blockchain Cryptography : Privacy and Security on Blockchain

Text Books:
1. Mark Gates, "Blockchain: Ultimate guide to understanding blockchain, bitcoin, cryptocurrencies, smart contracts and the future of money", Wise Fox Publishing and Mark Gates, 2017.
2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer", 2018.
3. ArshdeepBahga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", ArshdeepBahga, Vijay Madisetti publishers 2017.

Suggested Reading:
1. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media, Inc., 2014.
2. Melanie Swa, "Blockchain ",O'Reilly Media, 2014

E-Books :
1. Blockchain Applications- https://www.blockchain-books.com
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
3. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits,2017 - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc18_cs47/preview
2. https://www.udemy.com/blockchain-and-bitcoin-fundamentals/

16MTO 04 QUANTUM COMPUTINGELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are :

1. Translate fluently between the major mathematical representations and its quantum operations.
2. Implement basic quantum algorithms.
3. Explain quantum decoherence in systems for computation.
4. Discuss the physical basis of uniquely quantum phenomena.

Course Outcomes: On successful of this course student will be able to:

1. Explain the working of a Quantum Computing Program, its architecture and program model.
2. Compute basic mathematical operations.
3. Develop quantum logic gate circuits.
4. Develop quantum algorithm.
5. Program quantum algorithm on major toolkits.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	-	1	1	-
2	2	3	-	-	-	-	-	-	-	-	-	1	1	-
3	3	2	-	-	-	-	-	-	-	-	-	1	1	-
4	2	2	-	-	-	-	-	-	-	-	-	1	1	-
5	2	2	-	-	-	-	-	-	-	-	-	1	1	-

UNIT – I

Introduction to Quantum Computing: Motivation for Studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc), Origin of Quantum Computing, Overview of major concepts in Quantum Commuting (Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement).

UNIT – II

Math Foundation for Quantum Computing: Matrix Algebra: Basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen Vectors.

UNIT – III

Building Blocks for Quantum Program: Architecture of a Quantum Computing Platform, Details of q-bit system of information representation (Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from Quantum algorithmic perceptive e.g. Bell State.

UNIT – IV

Quantum Logic gates and Circuits: Quantum Logic gates and Circuit:Pauli, Hadamard, Phase shift, controlled gates, ising, Deutsch, Swap etc.), Programming model for a Quantum Computing program (Steps performed on classical computer, steps performed on Quantum Computer, Moving data between bits and qubits).

UNIT – V

Quantum Algorithms: Basic techniques exploited by quantum algorithms (Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum walks), Major Algorithms (Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm), OSS Toolkits for implementing Quantum program (IBM quantum experience, Microsoft Q, Rigetti PyQuil (QPU/QVM)).

Text Books:

1. Michael A.Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quanturm Computing Explained", Wiley.

16MEO 02 ROBOTICSELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. The configuration, work envelop and motion controls and applications
2. The kinematics and dynamics of robots.
3. Robot end effectors and their design.
4. Robot Programming Languages and Programming methods of robot.
5. Various Sensors and drives and their applications in robots

Course Outcomes: On successful of this course student will be able to:

1. Equipped with the knowledge of robot anatomy, work volume and robot applications
2. Familiarized with the kinematic motions of robot and robot dynamics
3. Having good knowledge about robot end effectors and their design concepts
4. Equipped with the Programming methods & drives used in robots
5. Equipped with the principles of various Sensors and their applications in robots.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	2	3	3	3	3	1	3	3	2	3	1	1
CO 2	3	3	3	3	3	0	1	0	2	3	1	3	1	1
CO 3	3	3	3	3	3	0	1	0	2	3	1	3	2	2
CO 4	2	3	3	3	3	3	2	1	3	3	2	3	3	2
CO 5	3	3	3	3	3	3	3	1	3	3	2	3	3	2

UNIT-I

Introduction to Robotics: History and evolution of robots, basic configuration, degree of freedom, work envelope, motion control methods. Various applications in industry: material handling, loading & unloading, processing, welding & painting, assembly and inspection. Requirements and Specifications of Robots

UNIT-II

Rigid Motions and Homogeneous Transformations: Rotation matrix, Homogenous transformation matrix, Denavit-Hartenberg convention, Euler angles, RPY representation, Direct and inverse kinematics for industrial robots for position and orientation.

UNIT-III

Velocity Kinematics – The Manipulator Jacobian: Joint, End effector velocity, direct and inverse velocity analysis. **Trajectory Planning**, interpolation, cubic polynomial, linear segments with parabolic blending, static force and moment transformation, solvability, stiffness, singularities.

UNIT-IV

Robot Dynamics: Lagrangian formulation, link inertia tensor and manipulator inertia tensor. **Newton**-Euler formulation for RR & RP manipulators. **Control**: Individual joint, computed torque.

UNIT-V

End Effectors: Position and velocity measurement, **Sensors**: Proximity and range, tactile, force and torque, Drives for Robots: Electrical, Hydraulic and Pneumatic. **Robot Vision**: Introduction to technique, image acquisition and processing, introduction to robot programming languages.

Text Books:

1. Spong and Vidyasagar, “Robot Dynamics and Control”, John Wile and Sons, 1990
2. R.K. Mittal, I.J. Nagrath, “Robotics and control”, Tata Mcgraw-Hill Publishing Company Ltd. 2003
3. Groover, “Industrial Robotics”, Mcgraw-Hill Publishing Company Ltd. 2003

Suggested Reading:

1. Asada and Slotine, “Robot analysis and Intelligence”, Wiley Interscience, 1986
2. K.S. Fu Gon ZalezRC., lEEc.S.G., “Robotics, Control Sensing Vision and Intelligence”, McGraw Hill, Int. Ed., 1987
3. Richard S. Paul, “Robot Manipulators: Mathematics, Programming, and Control”, MIT Press

16MEO 04 INTELLECTUAL PROPERTY RIGHTS ELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

Course Outcomes: On successful of this course student will be able to:

1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	3	-	1	-	-	-	2	-	-	-
2	-	-	-	-	3	-	1	-	-	-	2	-	-	-
3	-	-	-	-	3	-	1	-	-	-	2	-	-	-
4	-	-	-	-	3	-	1	-	-	-	2	-	-	-
5	-	-	-	-	3	-	1	-	-	-	2	-	-	-

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT, **Patents:** Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT-III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection. **Unfair Competition:** What is unfair competition. Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications", Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications", Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan, "Law of Copyright and Industrial Designs", Eastern law House, Delhi 2010

Suggested Reading:

1. W.R1 Cronish, "Intellectual Property; Patents, copyright, Trad and Allied rights", Sweet & Maxwell, 1993.
2. Narayanan, "Intellectual Property Law", Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs", 4/e, Sweet, Maxwell.

16PYO 01 HISTORY OF SCIENCE AND TECHNOLOGY ELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Enable students to understand science as a socio-cultural product in specific socio-historical contexts.
2. Expose students to philosophical, historical and sociological perspectives to look at science as a practice deeply embedded in culture and society.
3. Inculcate the scientific culture and ethics in the development of technologies.

Course Outcomes: On successful of this course student will be able to:
1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rig our and a sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	1	2	2	1	1	2	1	2		
2	3	1	2	1	2	2	2	1	2	2	2	2		
3	2	2	1	1	1	1	1	1	1	2	1	2	1	1
4	3	2	2	2	2	2	2	1	1	2	1	2	1	1
5	3	2	2	2	2	1	2	2	1	2	1	2	1	1

UNIT - I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization, Major advances. **Science in Antiquity (600 BC - 529 AD):** Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT - II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances. **The Renaissance and the Scientific Revolution (1453 AD – 1659 AD):** Renaissance, Scientific Revolution, Technology, Major advances.

UNIT - III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances. **The Industrial Revolution (1735 AD – 1819 AD):** Industrial Revolution, Rise of the engineer, Major Advances.

UNIT - IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances. **Rise of Modern Science and Technology (1895 AD – 1945 AD):** The growth of 20thcentury science, New philosophies, Quantum reality, Energy sources, Electricity: a revolution in Technology, Major advances.

UNIT - V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances. **The Information Age (1973 AD – 2015 AD):** Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances

Text Books:
1. Bryan and Alexander Hellemans, "The History of Science and Technology", Houghton Mifflin Company, 2004.
2. JD Bernal, "Science in History", 4 volumes, Kindle Edition.

Suggested Readings:
1. "The 100 Most Influential Scientists of All Time", Edited by Kara Rogers, Britannica Educational Publishing, 2010

2. Alberto Hernandez, “A Visual History of Science and Technology”, The Rosen Publishing Group, 2016

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(CBCS CURRICULUM)

OPEN ELECTIVE FOR OTHER PROGRAMME

S.NO.	SUBJECT CODE	SUBJECT NAME
1	16CSO 01	Python for Bioinformatics
2	16CSO 02	JAVA Programming and Bio-Java
3	16CSO 03	IOT and Applications
4	16CSO 04	Basics of Data Science using R
5	16CSO 05	Fundamentals of Virtual Reality
6	16CSO 06	Fundamentals of DBMS
7	16CSO 07	Basics of Cyber Security
8	16CSO 08	Open Source Technologies
9	16CSO 09	Basics of Artificial Intelligence
10	16CSO 10	Machine Learning Using Python

16CSO 01

PYTHON FOR BIOINFORMATICS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Introduce Python with reference to bioinformatics.
2. Understanding of various algorithms useful for biological sequences.
3. Identification Python modules useful to analyze gene and Biological sequences

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics of Python Programming.
2. Develop applications using Python to solve problems.
3. Identify and use Python modules related to Biology.
4. Analyze biological and gene sequences using Python.
5. Understand advanced analysis techniques.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	1	-	-	-	-	-	-	-	1	1	1
2	2	3	2	2	1	-	-	-	-	-	-	1	2	2
3	2	2	2	1	2	1	-	-	-	-	-	1	2	1
4	1	2	2	2	2	2	1	-	-	-	-	1	2	1
5	-	3	2	1	1	1	-	-	-	-	-	-	1	2

UNIT - I

Introduction to Python: Basics of Python, Python IDEs, Running Python programs, types and operations, Functions, modules, classes, Exceptions.

UNIT - II

Object-Oriented Programming, Modules: Object Oriented Programming, Threads, process, synchronization, databases and persistence, NumPy, SciPy, Image manipulation, Akando and Dancer modules.

UNIT - III

Biological Sequence Analysis: Biopython: Parsing DNA data files, Sequence Analysis, Dynamic Programming, Hidden Markov Model, Genetic Algorithms, Multiple Sequence Alignment, gapped alignment.

UNIT - IV

Advanced Analysis Techniques: Trees, Text Mining, Clustering, Self-Organizing Map, Principal Component Analysis and Numerical Sequence Alignment.

UNIT - V

Expression Analysis: Gene expression array analysis, Spot finding and Measurement, Spreadsheet Arrays and Data Displays, Applications with expression Alignment.

Text Books:

1. Jason Kinser, "Python for Bioinformatics", Jones & Bartlett Publishers, 2nd Edition, 2013.
2. Reema Thareja "Python Programming", Oxford Press, 2017.

Suggested Reading:

1. Mark Lutz, "Learning Python", 3rd edition, O'Reilly, 2007.
2. Alex Martelli, David Ascher, "Python cookbook", O'Reilly, 2002.

Online Resources:
1. http://www.biopython.org

16CSO 02

` JAVA PROGRAMMING AND BIO-JAVA

(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basics of any programming language.

Course Objectives: The main objectives of this course are:

1. To introduce the concepts of Object-Oriented programming.
2. Prepare the students to develop solutions using OOPs concepts.
3. Design and develop Biotechnology related solutions using Java and Java class libraries.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand fundamental concepts in object-oriented programming.
2. Design and develop computer based solutions to solve real world problems.
3. Handle file I/O and exceptions.
4. Create Windows, Containers, GUI components in Java.
5. Create GUI-based applications related to Biotechnology problems.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	-	-	1	1	-	-	-	-	1	1	-
2	2	2	3	2	1	1	1	-	-	-	-	1	2	1
3	2	2	2	1	2	-	-	-	-	-	-	1	1	1
4	2	2	1	1	1	-	-	-	-	-	-	1	1	1
5	2	2	3	1	2	-	-	-	-	-	-	2	2	2

UNIT - I

Java Essentials: Features of Java, OOPs concepts in Java, Elements of java program, Variables, and Literals, Data Types, variables and arrays, Operators, arrays Control structures: if, if-else, nested if, if-else-if, switch, while, do-while, for, break and continue statements.

UNIT - II

Classes and Objects: Introduction to classes and methods, typecasting, access specifiers and modifiers, modifiers, passing arguments, Constructors. Inheritance: Basics of inheritance, types of inheritance, polymorphism.

UNIT - III

Interfaces and Packages: Basics of interfaces, Packages, Exception handling: Types of exceptions and Errors, exception handling, Multithreading concepts. Files and I/O Streams: File Class, Streams, Byte Streams.

UNIT - IV

AWT and Applets: Applets, GUI, Window class hierarchy, Dialog Boxes,, Layout managers, Swing Component Classes, Event-Handling, AWT Graphics classes and Swing Controls.

UNIT - V

StrBio Lib: Molecular Biology Classes, Interfaces to Bioinformatics tools and Databases, General purpose tools, applications. Writing simple Java programs for Biotechnology related problems.

Text Books:

1. Sagayaraj, Denis, KArthik and Gajalaxmi, “Java Programming”, for Core and Adanced Learners”, University Press, Pvt. Ltd, 2018.
2. Johan-Marc Chandonia, “StrBioLib: a Java Library for Development of Custom Computations Structural Biology Applications”, BIO-INFO ALPPLICATIONS NOTE, Vol. 23, No. 15,2007, PP2018-2020 (https:// academic.oup.com/bioinformatics/article-abstract/23/15/2018/203542)

Suggested Reading:

1. Herbert Schildt, “ The complete reference Java 2”, TMH
2. Internet World 60 minute Java by Ed Tittel

Online Resources:

1. https://www.tutorialspoint.com/java/index.htm

16CSO 03

IOT AND APPLICATIONS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Programming Basics.

Course Objectives: The main objectives of this course are:

1. Impart necessary and practical knowledge of components in Internet of Things.
2. Understand working of IoT Systems.
3. Develop skills required to build IoT based systems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand Internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Remotely monitor data and control devices.
4. Develop real time IoT based projects.
5. Advance towards research based IoT.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	-	-	-	-	-	-	-	-	1	1	1
2	3	2	2	-	1	-	-	-	1	-	1	1	1	1
3	3	3	2	1	1	-	-	-	-	-	1	1	1	1
4	2	2	2	-	1		-	-	1	-	1	1	1	1
5	2	2	1	2	-	-	-	-	-	-	-	1	1	1

UNIT – I

Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators and Types of Actuators.

UNIT – II

Basics of Networking: Functional Components of IoT, IoT interdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

UNIT – III

IoT Hardware Components: Computing (Arduino/Raspberry Pi), Communication, Sensors, Actuators, I/O interfaces, Programming API's (for Arduino/ Raspberry Pi).

UNIT – IV

IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, Authorization of devices

UNIT – V

IoT Systems and Applications: Smart Lighting, Weather Monitoring System, Weather Reporting Bot, Forest Fire Detection, Alcohol Detection System, Smart Parking Environment.**,** Drip-irrigation, Biological water treatment system**,** Work flow Automation in Industries, Smart Intrusion Detection System, monitoring space risks and hazardous conditions in industrial regions like underground tanks, trap door margins.

Text Books:

1. Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.

Online Resources / Weblinks / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, "Internet of Things in Industries: A Survey ", IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. Gotovtsev, Pavel M., and Andrey V. Dyakov. "Biotechnology and Internet of Things for green smart city application." 2016 IEEE 3rd World Forum on Internet of Things (WF-IoT). IEEE, 2016.
3. Yanjing, Sun, et al. "Research and design of agriculture informatization system based on IOT." Journal of Computer Research and Development 48 (2011): 316-331.
4. Somov, Andrey, et al. "Bacteria to power the smart sensor applications: Biofuel cell for low-power IoT devices." 2018 IEEE 4th World Forum on Internet of Things (WF-IoT). IEEE, 2018.
5. Han, Shuqing, et al. "Analysis of the frontier technology of agricultural IoT and its predication research." IOP Conference Series: Materials Science and Engineering. Vol. 231. No. 1. IOP Publishing, 2017.

16CSO 04

BASICS OF DATA SCIENCE USING R
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Probability and Statistics, basics of programming languages.

Course Objectives: The main objectives of this course are:
1. Understand R programming language.
2. Explore the programming skills needed to use R tool for statistical analysis of Biological data.
3. Analyze biological data.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics of R, various statistical measures, algorithms useful for data analysis.
2. Explore the programming skills needed to use R tool for biological data.
3. Analyze biological data using R tool.
4. Apply classification and clustering algorithms to biological data.
5. Identify and work with the technologies and resources related to bioinformatics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	3	2	-	-	-	1	1	2	2	-
2	3	3	2	3	2	2	-	-	1	1	2	2	2	1
3	3	3	2	2	2	2	-	-	1	2	3	2	2	1
4	3	3	3	2	3	2	-	-	1	3	2	3	2	-
5	3	3	2	2	2	2	-	-	1	2	2	2	2	1

UNIT - I
Basics of R: Introduction, R features, setting up and exploring R environment, loading packages, types of data objects in R, working with R data objects, Controlling work space, importing files. **Programming with R:** Variables and assignment, operators, control structures, Functions-built-in, writing own functions, package creation.

UNIT - II
Data Analysis and Graphics: Data summary functions in R, Graphics technology in R, saving graphics, additional graphics packages. **Bayesian Data Analysis**: Need of Bayesian approach, Application of Bayes rule, Priors, Likelyhood functions, evaluating the posterior, Applications of Bayesial Statistics in Bioinformatics. **Stochastic Modeling**: Stochastic process and Markov Processes, Classification of Stochastic processes, modeling a DNA sequence with Markov Chain, Characteristics of Markov Chain.

UNIT - III
MCMC using Brugs: ABO blood type example. Gibbs sampling. **Statistical Inference:** Sampling distributions, Parameter estimation, interval estimation, bootstrapping, R packages for bootstrapping. **Hypothesis Testing**: Package ctest, Binomial test, comparing variances, Wilcoxon tests, Chi-Square test, Fisher's Exact tests, Likelihood Ratio tests.

UNIT - IV
ANOVA and Regression: ANOVA table, perforating ANOVA using R, graphical analysis of ANOVA comparison, Regression: Correlations, linear regression model, fitting and testing of regression model, generalization of the model. **Working with Multivariate Data:** Multivariate data, sample statistics, display of multivariate data, outliers and principal components. Classification of discriminate analysis- classification with two population and more than two populations, cross validation classification trees.

UNIT - V

Clustering methods: measures of dissimilarities, K-means clustering, K-Medoid clustering, Hierarchical clustering-Agglomerate and divisive. **R Packages:** Bio-conductor and Seqin R.

Data Technologies: R for Data manipulation, example, Database technologies, Bioinformatics resources on the WWW.

Text Books:

1. Kim Seefeld, Ernest Linder, "Statistics using R with Biological examples", 2007 (https://cran.r-project.org/doc/contrib/Seefeld_StatsRBio.pdf).
2. Robert Gentleman, "R Programming for Bioinformatics", 1st Edition, CRC Press, 2008.

Suggested Reading:

1. Arvil Cohhlan "A Little Book of R for Bioinformatics", Release 1.0, CC ver 3.0

Online Resources:

1. https://epdf.tips/r-programming-for-bioinformatics.html
2. https://epdf.tips/r-programming-for-bioinformatics.htmlhttps://www.cyclismo.org/tutorial/R/objectOriented.html
3. https://www.w3schools.in/r/object-oriented/

16CSO 05

FUNDAMENTALS OF VIRTUAL REALITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To introduce hardware and software components of virtual reality.
2. To provide knowledge about geometry of virtual worlds.
3. To understand visual physiology, perception and audio in VR.
4. To study the applications of VR in various domains like military and robotics.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Define Virtual Reality and acquire knowledge of virtual worlds.
2. Apply modeling techniques to model real world scenarios.
3. Study human factors for developing interfaces.
4. Evaluate virtual reality systems.
5. Address the issues and challenges in virtual reality.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	-	-	-	-	-	-	-	-	-	1	1	1
2	2	2	2	2	2	1	-	-	-	-	-	-	1	1
3	1	1	1	2	2	2	1	-	-	-	-	1	1	1
4	2	2	2	2	2	-	-	-	-	--	-	-	1	1
5	1	1	1	1	1	2	2	2	-	-	-	1	1	1

UNIT - I
Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. **Input Devices:** Trackers, Navigation and Gesture Interfaces: Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. **Output Devices:** Graphics displays, sound displays and haptic feedback.

UNIT - II
Geometry of Virtual Worlds: Geometric modeling, Transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, Axis-angle representations, Quaternions, Converting and multiplying rotations, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Canonical view transform , Viewport transform.

UNIT - III
Light and Optics : Three interpretations of light, Refraction, Simple lenses, Diopters, Imaging properties of lenses, Lens aberrations, Optical system of eyes. **Visual Physiology:** Photoreceptors, Sufficient resolution for VR, Light intensity, Eye movements, Eye movement issues for VR, Neuroscience of vision, **Visual Perception:** Depth perception, Motion perception, Frame rates and displays.

UNIT - IV
Tracking Systems : Overview, Orientation tracking, Tilt drift correction, Yaw drift correction, Tracking with a camera, Perspective n-point problem, Filtering, Lighthouse approach, **Visual Rendering:** Overview, Shading models, Rasterization, Pixel shading, VR-specific problems, Distortion shading, Post-rendering image warp.

UNIT – V
Audio: Physics and physiology, Auditory perception, Auditory localization, Rendering, Spatialization and display, Combining other senses, **Interfaces:** overview, Locomotion, Manipulation, System control, Social interaction, Evaluation of VR Systems, **Applications:** Medical, Military, Robotics, issues and challenges in virtual reality.

Text Books:

1. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007
2. Anad R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

Suggested Reading:

1. George Mather, "Foundations of Sensation and Perception:Psychology", Press; 2 edition, 2009.
2. Peter Shirley, Michael Ashikhmin, and Steve Marschner, "Fundamentals of Computer Graphics", A K Peters/CRC Press; 3 edition, 2009.

Online Resources:
1. http://msl.cs.uiuc.edu/vr/

16CSO 06

FUNDAMENTALS OF DBMS
(Open Elective)

Instruction 3 Hours per week
Duration of End Examination 3 Hours
Semester End Examination 70 Marks
CIE 30 Marks
Credits 3

Pre-requisites: File Structures.

Course Objectives: The main objectives of this course are:
1. To learn data models, conceptualize and depict a database system using E-R diagram.
2. To understand the internal storage structures in a physical DB design.
3. To know the fundamental concepts of transaction processing techniques.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Understand the find fundamental components of the DBMS.
2. Design the database schema and develop E-R model.
3. Devise queries using relational algebra and SQL.
4. Apply normalization techniques and solve problems using various Indexing techniques.
5. Understand transaction processing, Concurrency control and recovery techniques.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	1	-	-	--	-	-	-	-	-	1	2
2	3	3	3	1	-	-	-	-	-	-	-	-	1	2
3	2	2	3	1	-	-	-	-	-	--	-	-	1	2
4	1	3	2	2	-	-	-	-	-	-	-	-	1	2
5	3	1	2	1	-	2	-	1	-	-	-	-	1	2

UNIT - I
Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures. **Database Design and E-R Model:** Basic concepts, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT - II
Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations. **Structured Query Language:** Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT - III
Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT - IV
Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files. **Transaction Management:** Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT - V
Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery, **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions.

Text Books:
1. Abraham Silberschatz, Henry F Korth, S Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, “An Introduction to Database Systems”, Eight Edition, Pearson Education, 2006.

Suggested Reading:
1. Raghu Ramakrishnan, Johnnes Gehrke, “Database Management Systems”, Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, “Fundamentals of Database Systems”, Fourth Edition, Pearson Education,2006.

16CSO 07

BASICS OF CYBER SECURITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives: The main objectives of this course are:

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Course Outcomes: On Successful completion of this course, student will be able to

1. Discuss different types of cybercrimes and analyze legal frameworks to deal with these cybercrimes.
2. Describe Tools used in cybercrimes and laws governing cyberspace.
3. Analyze and resolve cyber security issues.
4. Recognize the importance of digital evidence in prosecution.
5. Analyze the commercial activities in the event of significant information security incidents in the Organization.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	1	3	1	1	1	-	-	2	-	1
2	3	2	2	3	3	2	1	2	2	1	-	2	-	2
3	2	3	1	3	3	3	1	2	3	2	2	3	-	1
4	2	2	1	3	3	3	1	2	3	2	1	2	-	1
5	2	3	2	3	3	2	1	2	3	2	2	3	-	1

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector.

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives**:** Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Sunit Belpre and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, Incident Response and computer forensics, Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, “Cyber Security and Cyber Laws”, Paperback – 2018.
2. Mark F Grady, Fransesco Parisi, “The Law and Economics of Cyber Security”, Cambridge university press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

16CSO 08

OPEN SOURCE TECHNOLOGIES
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Familiarity with Open Source Technologies.
2. Examples of OSS Projects, Advantages of Open Source.
3. Understand the principles, methodologies of OSS.
4. Understand the policies, licensing procedures and ethics of OSS.

Course Outcomes: On Successful completion of this course, student will be able to
1. Differentiate between Open Source and Proprietary software and Licensing.
2. Recognize the applications, benefits and features of Open Source Technologies.
3. Understand and demonstrate Version Control System along with its commands.
4. Gain knowledge to start, manage open source projects.
5. Understand and practice the Open Source Ethics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	2	2	2	-	-	-	2	1	1	1	3
2	2	2	3	3	2	2	1	1	1	1	2	2	1	3
3	3	3	3	3	3	3	1	-	2	2	3	1	2	3
4	3	3	3	2	3	3	2	2	2	3	2	3	1	3
5	3	3	2	2	2	2	2	3	1	2	2	2	1	3

UNIT – I

Introduction to Open Source: Open Source, need of Open Source, Open Source Principles, Open Source Standards Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Software Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT – II

Fault Tolerant Design: **Principles and Open Source Methodology**- History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copyleft, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT – III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, Libre Office.

UNIT – IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media, What Is A License, How to create your own Licenses. Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT – V

Open Source Ethics- Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:
1. Kailash Vadera, Bjhavesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press.

Suggested Reading:
1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, "Perspectives on Free and Open Source Software", MIT press.

16CSO 09

BASICS OF ARTIFICIAL INTELLIGENCE
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basic Mathematics.

Course Objectives: The main objectives of this course are:

1. Provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Differentiate between a rudimentary Problem and an AI problem, it's Characteristics and problem-solving Techniques.
2. Compare and contrast the various knowledge representation schemes of AI.
3. Understand and analyze the various reasoning and planning techniques involved in solving AI problems.
4. Understand the different learning techniques.
5. Apply the AI techniques to solve the real-world problems.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	1	-	-	-	-	-	-	-	-	2	1
2	3	2	2	1		-	-	-	-	-		-	-	2
3	3	2	2	2	-	-	-	-	-	-	-	-	-	-
4	3	2	3	1	-	-	-	-	-	-	-	1	-	-
5	3	3	2	2	1	-	-	-	--	-	-	2	-	-

UNIT - I

Introduction: Definition, history, applications. **Problem Solving:** AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate–and–test, Hill Climbing, Constraint Satisfaction.

UNIT - II

Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification. **Knowledge Representation (Structured):** Declarative representation, Semantic nets, procedural representation, frames.

UNIT - III

Reasoning: Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory. **Planning:** Components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT - IV

Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: Decision tree. **Intelligent Agents:** Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - V

Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition. **Perception and Action:** Real Time Search, Vision, Speech Recognition, ACTION: Navigation, Manipulation, Robot architectures.

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, "Artificial Intelligence", 3rd Edition, 2008
2. Russell Norvig, "Artificial Intelligence-Modern Approach", 3rd edition, 2010.

Suggested Reading:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2012.
2. Nelson M. Mattos, "An Approach to Knowledge Base Management", Springer Berlin Heidelberg, 1991.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

16CSO 10

MACHINE LEARNING USING PYTHON
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Get an idea of Machine Learning algorithms to solve real world problems.
2. Study various machine learning algorithms.
3. Analyze data using machine learning techniques.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics concepts of Machine Learning and Python.
2. Apply feature engineering techniques and visualization tools to the data.
3. Analyze the various types of data by using python based machine learning techniques.
4. Identify and evaluate various recommender systems.
5. Design solutions to real world problems using deep learning algorithms.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	1	-	-	1	1	1	-	1	2	1	2
2	2	1	1	-	1	1	1	1	1	1	-	1	2	1	2
3	2	3	1	1	2	-	-	1	2	2	1	2	2	2	2
4	2	2	1	1	2	-	-	1	1	1	1	2	2	2	2
5	2	2	2	1	2	1	1	2	2	2	1	2	3	2	3

UNIT - I
Introduction to Machine Learning: Introduction, Machine Learning process. **Introduction to Python**: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT - II
Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python. **Data Visualization:** Various charts, histograms, plots.

UNIT - III
Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression. **Classification:** Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes.

UNIT - IV
Unsupervised Learning: Clustering, K-Means clustering, Hierarchical clustering. **Text Analysis:** Basic text analysis with Python, regular expressions, NLP, text classification. **Time Series Analysis**: Date and time handling, window functions, correlation, time series forecasting.

UNIT - V
Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework. **Recommender System:** Recommendation engines, collaborative filtering.

Text Books:
1. Abhishek Vijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018
2. Tom Mitchel "Machine Learning", Tata McGraWHill, 2017
3. Reema Thareja "Python Programming", Oxford Press, 2017.

Suggested Reading:
1. Yuxi Liu, "Python Machine Learning by Example", 2nd Edition, PACT, 2017

Online Resources:
1. https://www.guru99.com/machine-learning-tutorial.html
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

SCHEME OF INSTRUCTION AND SYLLABI (R-20)

OF

B.E. I & II SEMESTERS

IN

COMPUTER SCIENCE & ENGINEERING

(For the batch admitted in 2020-21)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

Affiliated to Osmania University

Kokapet Village, Gandipet Mandal, Hyderabad– 500 075. Telangana

E-Mail: principal@cbit.ac.in; Website: www.cbit.ac.in; Phone Nos.: 040-24193276 / 277 / 279

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

INSTITUTE VISION AND MISSION:

Vision: To be a Centre of Excellence in Technical Education and Research

Mission: To address the emerging needs through quality technical education and advanced research

DEPARTMENT VISION AND MISSION:

Vision: To be in the frontiers of Computer Science and Engineering with academic excellence and Research

Mission: The mission of Computer Science and Engineering Department is to:
1. Educate students with the best practices of Computer Science by integrating the latest research into the curriculum
2. Develop professionals with sound knowledge in theory and practice of Computer Science and Engineering
3. Facilitate the development of academia-industry collaboration and societal outreach programs
4. Prepare students for full and ethical participation in a diverse society and encourage lifelong learning

PROGRAM EDUCATION OBJECTIVES (PEOs): After the completion of the program, our:
1. Graduates will apply their knowledge and skills to succeed in their careers and/or obtain advanced degrees, provide solutions as entrepreneurs
2. Graduates will creatively solve problems, communicate effectively, and successfully function in multi-disciplinary teams with superior work ethics and values
3. Graduates will apply principles and practices of Computer Science, mathematics and Science to successfully complete hardware and/or software-related engineering projects to meet customer business objectives and/or productively engage in research

PROGRAM SPECIFIC OUTCOMES (PSOs): At the end of the program
1. Graduates will acquire the practical competency in Computer Science and Engineering through emerging technologies and open-source platforms related to the domains
2. Graduates will design and develop innovative products by applying principles of computer science and engineering
3. Graduates will be able to successfully pursue higher education in reputed institutions and provide solutions as entrepreneurs.
4. Graduates will be able to work in multidisciplinary teams for career growth by exhibiting work ethics and values

ABOUT THE DEPARTMENT:

Department of CSE was established in the year 1985 with an intake of 20 students in UG program, gradually increased to 30 in 1991, 40 in 1993, 60 in 1994, 120 in 2000, 180 in 2013.Currently the department offers three UG programs BE (CSE), BE CSE (AI& ML), BE CSE (Internet of Things & Cyber Security including Block Chain Technology) with an intake of 300. M.Tech. CSE was started in the year 2002 with an intake of 18 and increased to 36 in 2011. The intellectual ambiance in CSE Department is conducive to the holistic development of the students.

BE-CSE program was first accredited by the NBA (AICTE) during 1998 with 'A' grade for 3 years , and further accredited during 2004, 2008, 2013 and 2017 consecutively. CSE department is a recognized Research center under Osmania University. CSE Faculty and students as part of their scholarly activities have published patents. Further both faculty and students have research publications in journals of international and national repute. In addition to the normal duties, faculty and Students continuously involve themselves in research and development activities. AICTE, UGC have funded research projects. Skill and Personality Development Centre and PRERANA centres are established with funds received through AICTE.

Department of CSE has centers of excellence in Internet of Things, Artificial Intelligence/Machine Learning, Cyber Security, Association for Artificial Intelligence in HealthCare. Department is also having MoU's with MSME, Robotic Process Automation, Kernel Sphere Technologies, Telangana State Council of Science and Technology and Data Security Council of India.

Department has committed well qualified and professionally active staff. Most of them are pursuing Ph.D. in the emerging areas like AI, ML, Cyber Security, Data Science, Data Mining and Block Chain .

Department is professionally active in conducting workshops and certifications with Microsoft, IBM, Oracle, SAP, Pega . Various activities are also conducted in collaboration with professional bodies like CSI, ISTE along with student branches of IEEE and CSI.

Department encourages the use of open source software and has vibrant technical clubs: CBIT Open Source (COSC) Club and CBIT Information Security Club (CISC). Through these clubs students have participated in various international and national Hackathons and bagged several prizes. Consecutively for the past three years CSE students have won first prize in Smart India Hackathon (SIH).

Students have participated in large numbers and won many worthy prizes in national and international coding competitions. They also presented papers in conferences and attended seminars, bootcamps and workshops.

CSE has maintained an excellent placement record by providing its students with ample opportunities to pursue their career goals. Leading companies that visited the campus for placements include Microsoft, JP Morgan, Accolite, NCR, Oracle, TCS, Infosys, Deloitte, D.E.Shaw, Sales Force, Service Now, Modak, etc., with CTC going well beyond 24 LPA. The number of students who are doing internship is gradually increasing year by year.

During 2017-18, 204 CSE students secured 287 job offers. In 2018-19, the offers increased to 291 for 214 students, further 311job offers for 224 students during 2019-20. The salary trend in CSE has improved over the years with an average salary being 7.1 LPA. The highest salary offered in Placement 2020 is 41.6 LPA. Microsoft offered the highest CTC of 41.60 LPA. Six students have got their placement in Microsoft with the Super Dream Offer. From the batch of 211 students, 65 students secured multiple job offers out of which 23 students secured three offers.

ABOUT B.E. (CSE) PROGRAM:

In order to understand the needs and problems in the real world, one must have the foundational aspects of computing, science and engineering skills to create, invent, generate, contrive, devise ideas with their ingenium.

B.E Computer Science and Engineering program begins with basic sciences and mathematics, which gives theoretical foundational knowledge for computing .Students acquire knowledge in computing and application domains at different levels of abstraction which includes hardware and software related courses, efficient models, techniques, algorithms for handling data. Students learns modern tools and methodologies which can be applied for the real world problems.

The first half of BE (CSE) program focuses on building the foundations and the second half is for developing the skills and knowledge of the students in various computing and application domains of their choice.

This program is best suited for students seeking to build world-class expertise in Computer Sciences or to undertake advanced studies for research careers or to take up Entrepreneurship.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of I Semester of B.E. – Computer Science & Engineering as per AICTE Model Curriculum 2020-21

B.E. - COMPUTER SCIENCE & ENGINEERING

SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20MT C01	Linear Algebra & Calculus	3	-	-	3	40	60	3
2	20EG C01	English	2	-	-	3	40	60	2
3	20PY C01	Optics and Semiconductor Physics	3	-	-	3	40	60	3
4	20CS C01	Programming for Problem Solving	3	-	-	3	40	60	3
PRACTICAL									
5	20MT C02	Linear Algebra & Calculus Lab	-	-	2	3	50	50	1
6	20EG C02	English lab	-	-	2	3	50	50	1
7	20PY C03	Optics and Semiconductor Physics Lab	-	-	4	3	50	50	2
8	20CS C02	Programming for problem Solving Lab	-	-	4	3	50	50	2
9	20ME C01	CAD AND DRAFTING	-	1	3	3	50	50	2.5
10	20MB C02	Community Engagement	30 field + 2P/W			-	50	-	1.5
TOTAL			**11**	**1**	**15**	**-**	**460**	**490**	**21**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

with effect from the Academic Year 2020-21

20MT C01

LINEAR ALGEBRA & CALCULUS
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To explain the solutions of system of linear equations by Matrix Methods.
2. To discuss the convergence and divergence of the Series.
3. To explain the Partial Derivatives and the extreme values of functions of two variables
4. To discuss Physical interpretations on Scalars and vector functions
5. To discuss vector line, surface and volume integrals.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the Matrix Methods to solve the system of linear equations
2. Test the convergence and divergence of the infinite Series.
3. Determine the extreme values of functions of two variables.
4. Apply the vector differential operator to scalar and vector functions
5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.

UNIT-I

Matrices: Rank of a matrix, Echelon form, consistency of linear System of equations, Linear dependence of vectors, Eigen values, Eigenvectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-II

Infinite Series: Definition of Convergence of sequence and series. Series of positive terms –Necessary condition for convergence, Comparison tests, limit form comparison test, D'Alembert's Ratio test, Raabe's test, Cauchy's root test, alternating series, Leibnitz's rule, absolutely and conditionally convergence.

UNIT-III

Partial Differentiation and Its Applications : Functions of two or more variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions, Jacobians, Taylor's expansion of functions of two variables, Maxima and minima of functions of two variables.

UNIT-IV

Vector Differential Calculus: Scalar and vector point functions, vector operator Del, Gradient, Directional derivative, Divergence, Curl, Del applied twice to point functions, Del applied to product of point functions (vector identities). Applications: Irrotational fields and Solenoidal fields.

UNIT-V

Vector Integral Calculus: Line integral, Surface integral and Volume integral. Green's theorem in the plane, verifications of Stroke's theorem (without proof) and Gauss's divergence theorem (without proof).

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition,2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw- Hill, New Delhi,2 008.
2. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

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20 EG C01

ENGLISH
(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Course Objectives: This course will introduce the students:

1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

Course Outcomes: After successful completion of the course the students will be able to:

1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques

UNIT-I Understanding Communication in English:
Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.
Vocabulary &Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT-II Developing Writing Skills I:
Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.
Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT-III Developing Writing Skills II:
Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response
Vocabulary and Grammar: Subject-verb agreement.
Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

UNIT-IV Developing Writing Skills III:
Report writing – Importance, structure, elements of style of formal reports ; Writing a formal report.
Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

UNIT-V Developing Reading Skills:
The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar: Words often confused; Use of standard abbreviations.

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP. 1995.

Suggested Readings:

1. Wood F.T, Remedial English Grammar,Macmillan,2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, Communication Skills. Oxford University Press, 2011.

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Code: 20PY C01

OPTICS AND SEMICONDUCTOR PHYSICS

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	3 L / week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of the course is to make the student

1. Understand the fundamentals of wave nature of light
2. Acquire knowledge of lasers, holography and fiber optics
3. Familiarize with quantum mechanics
4. Learn the fundamental concepts of solids

Course Outcomes: At the end of the course, the student will be able to

1. Demonstrate the physical properties of light.
2. Explain characteristic properties of lasers and fiber optics
3. Find the applications of quantum mechanics
4. Classify the solids depending upon electrical conductivity
5. Identify different types of semiconductors

UNIT-I

Wave Optics: Huygens' principle –Superposition of waves –Interference of light by wave front splitting and amplitude splitting–Fresnel's biprism – Interference in thin films in reflected light– Newton's rings– Fraunhofer diffraction from a single slit –Double slit diffraction – Rayleigh criterion for limit of resolution– Concept of N-slits–Diffraction grating and its resolving power.

UNIT-II

Lasers & Holography: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion –Different types of lasers: solid-state lasers: Ruby & Nd:YAG; gas lasers: He-Ne & CO_2; semiconductor laser –Applications of lasers in engineering and medicine. Holography: Principle – Recording and reconstruction–Applications.

Fiber Optics: Introduction –Construction –Principle –Propagation of light through an optical fiber – Numerical aperture and acceptance angle –Step-index and graded-index fibers –Pulse dispersion –Fiber losses–Fiber optic communication system –Applications.

UNIT-III

Principles of Quantum Mechanics: Introduction –Wave nature of particles – de-Broglie hypothesis – Physical significance of ψ –Time-dependent and time-independent Schrodinger equations – Born interpretation – Probability current –Wave packets –Uncertainty principle –Particle in infinite square well potential –Scattering from potential step – Potential barrier and tunneling.

UNIT-IV

Band Theory of Solids: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level –Density of states – Bloch's theorem for particles in a periodic potential – Kronig-Penney model – Classification of solids: metals, semiconductors and insulators.

UNIT-V

Semiconductors: Intrinsic and extrinsic semiconductors –Charge carrier concentration in intrinsic semiconductors – Dependence of Fermi level on carrier concentration and temperature in extrinsic semiconductors (qualitative) –Carrier generation and recombination –Carrier transport: diffusion and drift – P-N junction – Thermistor – Hall effect – LED –Solar cell.

Text Books:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

Suggested Reading:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

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20CS C01

PROGRAMMING FOR PROBLEM SOLVING
(Common to all Programs)

Instruction	3 Periods per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
4. Develop in tuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and understand the computing environments for scientific and mathematical problems.
2. Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
3. Choose data types and control structures to solve mathematical and scientific problem.
4. Decompose a problem into modules and use functions to implement the modules.
5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high-level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence, and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping, and nested statements.

Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes, Case study using functions and control statements.

UNIT – III

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting (Selection and Bubble) algorithms, 2-D arrays, matrix operations.

Strings: Introduction, strings representation, string operations with examples. Case study using arrays.

UNIT – IV

Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, dynamic memory allocation, advantages, and drawbacks of pointers.

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions, and enumerated data types.

UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.

Preprocessor Directives: Types of preprocessor directives, examples.

Text Books:

1. M.T. Somashekar “Problem Solving with C”, 2nd Edition, Prentice Hall India Learning Private Limited 2018
2. AK Sharma, “Computer Fundamentals and Programming”, 2nd Edition, University Press, 2018
3. Pradeep Deyand Manas Ghosh, “Programming in C”, Oxford Press, 2nd Edition, 2017

Suggested Reading:

1. Byron Gottfried, Schaum’s Outline of Programming with C”, Mc Graw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Reema Tharaja “Introduction to C Programming”, Second Edition, OXFORDPress,2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm.
2. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

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20MT C02

LINEAR ALGEBRA & CALCULUS LAB

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	2P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To explain basic operations of matrix algebra.
2. To discuss the behavior of the infinite Series.
3. To discuss the maxima and minima of the functions of two variables
4. To discuss Physical interpretations on Scalars and vector functions.
5. To explain vector line, surface and volume integrals.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the Matrix operations in executing various programmes.
2. Test the convergence and divergence of the infinite Series.
3. Explore the extreme values of functions of two variables.
4. Determine the gradient, divergent and curl of scalar and vector point functions.
5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems

LIST OF EXPERIMENTS:

1. Addition and multiplication of higher order matrices.
2. Determinant and Inverse of the matrices
3. Eigen values and Eigenvectors of Matrix.
4. Nature of quadratic form of Matrix.
5. Solution of system of linear equations.
6. Data plotting (2D,3D)
7. Test the convergence of infinite series
8. Examine the extreme values of given function
9. Examine the rotational, irrotational and divergence of the flows
10. Verify inter connection between vector theorems (Green's, Gauss and Stoke's Theorems)

Text Books / Suggested Reading / Online Resources:

1. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
2. https://www.scilab.org/tutorials\
3. https://nptel.ac.in/courses/106102064/
4. https://www.udemy.com/algorithms-and-data-structures-in-python/

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20EG C02

ENGLISH LAB
(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives: This course will introduce the students:

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behavior while developing their ability to discuss in groups and making oral presentations.

Course Outcomes: After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams, and discuss and participate in Group discussions.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm &Intonation:** Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material
6. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary –** weaving an imaginative story around a given picture.
9. **Information Gap Activity –** Writing a brief report on a newspaper headline by building on the hints given
10. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt. Ltd., 2011
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016

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20PY C03

OPTICS AND SEMICONDUCTOR PHYSICS LAB

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block chain Technology))

Instruction	4 Periods / week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

Course Objectives: The objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments
2. Understand the behaviour of the light experimentally
3. Analyze the conduction behaviour of semiconductor materials and optoelectronic devices

Course Outcomes: At the end of the course, the student will be able to

1. Interpret the errors in the results of an experiment.
2. Demonstrate physical properties of light experimentally
3. Make use of lasers and optical fibers for engineering applications
4. Explain the V-I characteristics of some optoelectronic and semiconductor devices
5. Find the applications thermistor

Experiments

1.	Error Analysis	:	Estimation of errors in the determination of time period of a torsional pendulum
2.	Fresnel's Biprism	:	Determination of wavelength of given monochromatic source
3.	Newton's Rings	:	Determination of wavelength of given monochromatic source
4.	Single Slit Diffraction	:	Determination of wavelength of given monochromatic source
5.	Diffraction Grating	:	Determination of wavelengths of two yellow lines of light of mercury lamp
6.	Laser	:	Determination of wavelength of given semiconductor laser
7.	Holography	:	Recording and reconstruction of a hologram
8.	Optical Fiber	:	Determination of numerical aperture and power losses of given optical fiber
9.	Energy Gap	:	Determination of energy gap of given semiconductor
10.	P-N Junction Diode	:	Study of V-I characteristics and calculation of resistance of given diode in forward bias and reverse bias
11.	Thermistor	:	Determination of temperature coefficient of resistance of given thermistor
12.	Hall Effect	:	Determination of Hall coefficient, carrier concentration and mobility of charge carriers of given semiconductor specimen
13.	LED	:	Study of I-V characteristics of given LED
14.	Solar Cell	:	Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance
15.	Planck's Constant	:	Determination of Planck's constant using photo cell

NOTE: A minimum of TWELVE experiments should be conducted

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20CS C02

PROGRAMMING FOR PROBLEM SOLVING LAB
(Common to All Programs)

Instruction	4 Periods per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

Course Objectives: The objectives of this course are

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and setup program development environment.
2. Design and test programs to solve mathematical and scientific problems.
3. Identify and rectify the syntax errors and debug program for semantic errors
4. Implement modular programs using functions.
5. Represent data in arrays, pointers, structures and manipulate them through a program.
6. Create, read, and write to and from simple text files.

Lab experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

Text Books:

1. Pradeep Dey and Manas Ghosh, "Programming in C", Oxford Press, 2nd Edition, 2017.
2. Reema Tharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

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20ME C01

CAD AND DRAFTING

Instruction	1 T + 3 D Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives:

1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

Outcomes: At the end of the course, the Students are able to

1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

List of Exercises:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice versa.

Text Books:

1. N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishers, 2012.
2. K.Venugopal, “Engineering Drawing and Graphics + AutoCAD”, New Age International Pvt. Ltd, 2011.
3. Basanth Agrawal and C M Agrawal, “Engineering Drawing”, 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., “Engineering Drawing”, 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011.

20MBC02

COMMUNITY ENGAGEMENT

Instruction	3 Hours per week (30 hours field work & 2 hours per week)
SEE	Nil
CIE	50 Marks
Credits	1.5 Credits

Course Objectives: The main Objectives of this Course are to:
1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

Course Outcomes: After the completion of this Course, Student will be able to:
1. Gain an understanding of Rural life, Culture and Social realities.
2. Develop a sense of empathy and bonds of mutuality with Local Communities.
3. Appreciate significant contributions of Local communities to Indian Society and Economy.
4. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
5. Utilise the opportunities provided by Rural Development Programmes.

Module I Appreciation of Rural Society

Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

Module II Understanding Rural Economy and Livelihood

Agriculture, Farming, Landownership, Water management, Animal Husbandry, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III Rural Institutions

Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees, Local Civil Society, Local Administration.

Module IV Rural Development Programmes

History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

Text Books:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

Journals:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of II Semester of B.E. – Computer Science & Engineering as per AICTE Model Curriculum 2020-21

B.E. - COMPUTER SCIENCE AND ENGINEERING

SEMESTER -II

S. No	Course Code	Title of the Course	Scheme of Instruction: Hours per Week			Scheme of Examination			Credits
			L	T	P/D	Duration of SEE in Hours	Maximum Marks: CIE	Maximum Marks: SEE	
THEORY									
1	20MT C03	Differential Equations & Transform Theory	3	-	-	3	40	60	3
2	20CYC01	Chemistry	3	-	-	3	40	60	3
3	20CS C05	Industry 4.0	3	-	-	3	40	60	3
4	20CS C03	Object Oriented Programming	3	-	-	3	40	60	3
PRACTICAL									
5	20MT C04	Differential Equations &Transform Theory Lab	-	-	2	3	50	50	1
6	20CYC02	Chemistry Lab	-	-	4	3	50	50	2
7	20CSC04	Object Oriented Programming Lab	-	-	2	3	50	50	1
8	20ME C02	Workshop / Manufacturing Practice			5	3	50	50	2.5
9	20ME C03	Engineering Exploration	90 Hours / 4P			-	50	-	1.5
		TOTAL	**12**	**-**	**13**	**-**	**410**	**440**	**20**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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20MT C03

DIFFERENTIAL EQUATIONS &TRANSFORM THEORY
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IOT &Cyber Security including Block Chain Technology))

Instruction	3 L per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss the properties of Legendre's Polynomials and Bessel's functions
4. To explain the Z-Transform and InverseZ-Transforms.
5. To discuss Fourier transform for solving engineering problems.

Course Outcomes:

Upon completing this course, students will be able to:

1. Calculate the solutions of first order linear differential equations.
2. Calculate the solutions of higher order linear differential equations.
3. Examine the series solutions for higher order differential equations.
4. Evaluate the Improper integrals by Fourier Transform.
5. Solve the difference equations byZ-transforms.

UNIT - I

Differential Equations of First Order: Exact Differential Equations, Equations Reducible To Exact Equations, Linear Equations, Bernoulli's Equations, Riccati's and Clairaut's Equations, Orthogonal trajectories.

UNIT-II

Higher Order Linear Differential Equations: Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Cauchy's homogeneous linear equation. applications: LR and LCR circuits.

UNIT-III

Series Solutions of Differential Equations: Ordinary point, singular point and regular singular point, Series solution when **x=a** is an ordinary point of the equation. Legendre's equation, Legendre's Polynomial of first kind (without proof), Rodrigue's formula, orthogonality of Legendre polynomials. Bessel's equation, Bessel's function of the first kind of order n (without proof), recurrence formulae for **Jn(x)** and related problems (i.eJ0(x), J1(x), J1/2(x), J-1/2(x), J3/2 (x), J-3/2(x)).

UNIT-IV

Fourier Transforms: Fourier integral theorem (statement), Complex form of Fourier integrals. Fourier transforms, Inverse Fourier Transforms, Fourier Sine and Cosine transforms, Inverse Fourier Sine and Cosine Transforms. Properties of Fourier transforms: Linear property, change of scale property, shifting property and Modulation theorem.

UNIT-V

Z-Transforms: Definition, some standard Z-transforms, linearity property, damping rule, shifting U_n to the right, shifting U_n to the left, multiplication by 'n', initial and final value theorems. Inverse Z-Transform: evaluation of Inverse Z-transform by Convolution theorem, partial fractions method. Z- Transform application to difference equations.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley& Sons, 2006.
3. R.K.Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.

Suggested Reading:

1. N.P.Bali and Manish Goyal, Atext book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. A.R.Vasishtha, and R.K.Guptha Integral transforms, Krishna Prakashan Media, Reprint, 2016

with effect from the Academic Year 2020-21

20CY C01

CHEMISTRY

(Common to all branches)

Instruction:	3Hours per Week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE	40 Marks
Credits:	3

Course Objectives

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

Course Outcomes

At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

UNIT-I Atomic and molecular structure and Chemical Kinetics:

Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2 , He_2^+ ,N_2 , O_2 , O_2^- , CO, NO). Pi- molecular orbitals of benzene and its aromaticity.

Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction-Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, – Reference electrodes (NHE, SCE)-electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations. Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.

Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages.

Construction, working & applications of methanol-oxygen fuel cell.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism - Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid) & Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.

Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)

Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)
Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides)
Cyclization (Diels - Alder reaction)

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process),ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V Engineering Materials and Drugs:
Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber). Conducting polymers- Definition, classification and applications.
Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography.
Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation-Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle).
Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition (2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla, Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Readings:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

Professor and Head Department

20CS C05

INDUSTRY 4.0

Instruction	3 Hours per week
Duration of End Examination	3Hours
SEE	60 Marks
CIE	40Marks
Credits	3

Prerequisite: Nil. No prior technical background is required

Course Objectives: The main objectives of this course are to:
1. Offer the students an introduction to Industry 4.0 and its applications to in the business world
2. Give deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges

Course Outcomes: On successful completion of this course, students will be able to:
1. Identify the key drivers and enablers of Industry4.0
2. Describe the smartness in smart factories, smart cities, smart products, ad smart services
3. Determine various systems used in manufacturing plants, and their role in an Industry 4.0world
4. Illustrate the power of Cloud Computing in a networked economy
5. Understand the opportunities, challenges, brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits

UNIT-1

Introduction to Industry 4.0: Various Industrial revolutions, Digitalization and the networked economy, drivers, enablers, compelling forces and challenges for Industry 4.0,Mega trends, Tipping points, comparison of Industry 4.0 Factory and Today's Factory, trends of industrial Big Data and predictive analytics for business transformation

UNIT-2

Road to Industry 4.0: Internet of Things(IoT) and Industrial Internet of Things (IIoT) and Internet of Services, smart manufacturing, smart devices and products, smart logistics, smart cities, predictive analytics

UNIT-3

Related disciplines, systems, technologies for enabling Industry 4.0: Cyber physical systems, robotic automation and collaborative robots, support system for Industry 4.0, mobile computing, related disciplines, Cyber security, Augmented Reality and Virtual Reality, Artificial Intelligence

UNIT-4

Role of data, information, knowledge and collaboration: Resource-based view of a firm, data as a new resource for organizations, harnessing and sharing knowledge in organizations, cloud computing basics, cloud computing and Industry 4.0

UNIT-5

Other Applications and Case Studies: Industry 4.0 laboratories, IIoT case studies, Opportunities and challenges, future of works and skills for workers in the Industry 4.0 era, strategies for competing in an Industry world

Text Book:
1. Klaus Schwab. The Fourth Industrial Revolution. 2017. Portfolio Penguin.
2. Pranjal Sharma. India Automated: How the Fourth Industrial Revolution is Transforming India. 2019. Macmillan; 1edition
3. https://swayam.gov.in/nd1_noc20_cs69/preview

Suggested Reading:
1. Bruno S. Sergi, Elena G. Popkova, Aleksei V. Bogoviz, Tatiana N. Litvinova. Understanding Industry 4.0: AI, the Internet of Things, and the Future of Work. 2019. Emerald Publishing Limited. ISBN: 9781789733129
2. Dominik T. Matt, Vladimír Modrák, Helmut Zsifkovits. Industry 4.0 for SMEs: Challenges, Opportunities and Requirements. Palgravemacmillan

20CS C03

OBJECT ORIENTED PROGRAMMING

Instruction	3 Periods per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of this course are
1. Describe the principles of Object-Oriented Programming.
2. Enable the students to solve problems using OOPs features.
3. Debugging in programs and files.
4. Use of library modules to develop GUI applications.

Course Outcomes: On Successful completion of the course, students will be able to
1. Demonstrate the concepts of Object-Oriented Programming languages to solve problems.
2. Apply the constructs like selection, repetition, functions and packages to modularize the programs.
3. Design and build applications with classes/modules.
4. Find and rectify coding errors in a program to assess and improve performance.
5. Develop packages for solving simple real world problems.
6. Analyze and use appropriate library software to create graphical interface, mathematical software.

Unit-I

Introduction to Object Oriented Programming : Computer Programming and Programming Languages, Programming Paradigms, Features of Object Oriented Programming, Merits and Demerits of OOPs
Basics of Python Programming: Features of Python, Variables, Identifiers, Data types, Input/ Output operations, Operators and Expressions, Operations on Strings, Type Conversion.

Unit-II

Decision Control Statement : Selection/Conditional Branching, Loop Control Structures, Nested Loops. **Functions and Modules**: Uses of functions, Function definition, function call, Variable scope and Lifetime, Recursion, Lambda functions, map, reduce and filter built-in functions, Recursive Functions, Modules, Packages.

Unit-III

Classes and Objects: Introduction, Classes and Objects, init method, Class variables, and Object variables, Public and Private Data members, calling methods from other methods, built-in class attributes, garbage collection, class methods, static methods.

Unit-IV

Inheritance: Introduction, Inheriting classes, Polymorphism and method overloading, Composition or Containership, Abstract classes and inheritance.
Operator Overloading: Introduction, Implementation of Operator Overloading, Overriding.
File Handling: File types, opening and closing files, reading and writing files, file positions, Regular Expressions.

Unit-V

Error and Exception Handling: Introduction to errors and exceptions, Handling Exceptions, Simple GUI Programming with *tkinter* package, Sample Graphics using *Turtle*, Plotting Graphs in Python.

Text Books:

1. Reema Thareja, “Python Programming”, Oxford Press, 2017.
2. Mike Mc Grath “Python in easy steps: Makes Programming Fun”, Kindle Edition, 2017.

Suggested Readings:

1. Mark Lutz “Learning Python”, O’Reilly Media Inc., 5^{th}Edition2013
2. Mark Summerfield “Programming in Python 3: A Complete Introduction to the Python, Addison–Wesley, 2^{nd} Edition.

References:

1. https://anandology.com/python-practice-book/object_oriented_programming.html
2. http://python-textbok.readthedocs.io/en/1.0/Object_Oriented_Programming.html
3. http://www.tutorialspoint.com/python/python_classes_objects.html
4. https://docs.python.org/3/

with effect from the Academic Year 2020-21

20MT C04

DIFFERENTIAL EQUATIONS &TRANSFORM THEORY LAB
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IOT & Cyber Security including Block Chain Technology)

Instruction	2P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss the properties of Legendre's Polynomials and Bessel's functions
4. To explain the Z-Transform and InverseZ-Transforms.
5. To discuss Fourier transform for solving engineering problems.

Course Outcomes:

Upon completing this course, students will be able to:

1. Explore all the possible solutions of first order differential equation.
2. Analyse the solutions of higher order linear differential equations.
3. Examine the series solutions for higher order differential equations.
4. Evaluate the Improper integrals by Fourier Transform.
5. Apply the Z-transform to solve the difference equations.

List of Programmes:

1. Solution of first order liner differential equations.
2. Solution of first order non liner differential equations
3. Geometrical view of Particular integral of higher order differential equations.
4. Simulations of Legendre's differential equations.
5. Geometrical view of Rodrigue's theorem.
6. Simulations of Bessel's first kind solution.
7. Solutions of Bessel's first kind
   (i.e. J0(x), J1(x), J1/2(x), J3/2 (x), J-1/2(x), J-3/2(x))
8. Waveform generation continuous signals
9. Computation of Fourier Transformations
10. Discrete Cosine Transforms
11. Digitization of continuous functions.

Text Books / Suggested Reading / Online Resources:

1. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
2. https://www.scilab.org/tutorials\
3. https://nptel.ac.in/courses/106102064/
4. https://www.udemy.com/algorithms-and-data-structures-in-python/

Professor and Head Department
[illegible]
Hyderabad-500 075 (T.S.)

20CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	4 Hours per Week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	2

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theorical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes

At the end of the course student will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

Chemistry Lab

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2}& Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

Text Books:

1. J. Mendham and Thomas , "Vogel's text book of quantitative chemical analysis", Pearson education Pvt. Ltd. New Delhi , 6th ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg & A.Gulati,; R. Chand & Co. : New Delhi (2011).

Suggested Readings:

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

20CS C04

OBJECT ORIENTED PROGRAMMING LAB

Instruction	2 Periods per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives: The objectives of this course are
1. Identification and installation of required software to work with Python.
2. Program development using OOPs concepts.
3. Handling of errors in program code.
4. Use of library modules to develop GUI applications.

Course Outcomes: On Successful completion of the course, students will be able to
1. Inspect and identify suitable programming environment to work with Python.
2. Choose appropriate control constructs, data structures to build the solutions.
3. Develop the solutions with modular approach using functions, packages to enhance the code efficiency.
4. Analyze and debug the programs to verify and validate code.
5. Demonstrate use of STLs and modules to build graphical interfaces, mathematical software.
6. Determine the requirements of real-world problems and use appropriate modules to develop solutions.

Lab Experiments:
1. Installation of any Object Oriented Programming Language and IDE.
2. Simple scripts to demonstrate the use of basic data types and operators.
3. Simple scripts to demonstrate the use of control structures.
4. Functions and Lambda function and parameter passing.
5. Experimentation with Modules.
6. Implementation of classes with attributes and methods.
7. Demonstration of inheritance.
8. Experiments on Overloading.
9. Files and Regular Expressions.
10. Exceptions and built-in tools.
11. Experiments on System interfaces and GUIs.

Text Book:
1. Reema Thareja, "Python Programming", Oxford Press, 2017.

Online Resources:
1. https://vknight.org/cfm/labsheets/04-object-oriented-programming/
2. http://learning-python.com/class/Workbook/x-exercises.htm
3. https://inst.eecs.berkeley.edu/~cs61a/fa14/lab/lab06/#inheritance
4. https://anandology.com/python-practice-book/object_oriented_programming.html
5. http://stanfordpython.com/
6. https://docs.python.org/3/

Professor and Head Department

20ME C02

WORKSHOP / MANUFACTURING PRACTICE

Instruction	5P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive &team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes: At the end of the course, the students are able to

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
3. Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
4. Perform various operations in welding, machining and casting processes.
5. Conceptualize and produce simple device/mechanism of their choice.

List of Exercises

CYCLE 1

Exercises in Carpentry

1. To plane the given wooden piece to required size
2. To make a lap joint on the given wooden piece according to the given dimensions.
3. To make a dove tail-joint on the given wooden piece according to the given dimensions.

Exercises in Tin Smithy

1. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
2. To make a scoop.
3. To make a pamphlet box.

Exercises in Fitting

1. To make a perfect rectangular MS flat and to do parallel cuts using Hacksaw
2. To make male and female fitting using MSflats-Assembly1
3. To make male and female fitting using MSflats-Assembly2

Exercises in House Wiring

1. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch, and wiring of one buzzer controlled by a bellpush
2. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket
3. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- way switches.

Professor and Head Department

CYCLE 2

Exercises in Casting

1. Study of Sand casting process and its applications**.**
2. Green sand moulding practice for a single piece pattern
3. Green sand moulding practice for a split pattern with a horizontal core

Exercises in Welding

1. Study of gas welding equipment and process. Identification of flames, making of Butt joint with gas welding.
2. Study of Arc welding process, making Butt joint with DCSP,DCRP
3. Study of Arc welding process, making Lap joint with A.C

Exercises in Machine shop

1. Study of Machine Tools like Lathe, Drilling, Milling and Shaper.
2. Facing, Plain turning and Step turning operations on Lathe machine.
3. Knurling and Taper turning on Lathe machine

Open ended Exercise:

1. Student should produce a component /mechanism by applying the knowledge of any one trade or combination of trades.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I, 2008 and Vol. II, 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I”, Pearson Education, 2008.
2. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.

20ME C03

ENGINEERING EXPLORATION
(PRACTICAL)

Instruction	4 Hours per week
Duration of SEE	Nil
SEE	Nil
CIE	50Marks
Credits	1.5

Prerequisites: Nil

Course Outcomes: At the end of the course, the students are able to

1. Understand the role of an engineer as a problem solver.
2. Identify multi-disciplinary approaches in solving an engineering problem.
3. Build simple systems using engineering design process.
4. Analyze engineering solutions from ethical and sustainability perspectives.
5. Use basics of engineering project management skills in doing projects.

UNIT- I
Role of Engineers: Introduction, science, engineering, technology, engineer, scientist, role of engineer, various disciplines of engineering, misconception of engineering, expectations for the 21st century engineer and NBA graduate attributes.
Engineering problems and Design: Multidisciplinary facet of design, pair wise comparison chart, introduction to econometrics system, generation of multiple solution, Pugh chart, motor and battery sizing concepts, introduction to PCB design.

UNIT- II
Mechanisms: Basic components of a mechanism, degrees of freedom or mobility of a mechanism, 4-bar chain, crank rocker mechanism, slider crank mechanism, simple robotic arm building.
Platform-based development: Introduction to programming platforms (Arduino) and its essentials, sensors, transducers and actuators and their interfacing with Arduino.

UNIT- III
Data Acquisition and Analysis: Types of data, descriptive statistics techniques as applicable to different types of data, types of graphs and their applicability, usage of tools (MS-Office /Open Office/ Libre Office / Scilab) for descriptive statistics, data acquisition (temperature and humidity) using sensors interfaced with Arduino, exporting acquired data to spreadsheets, and analysis using representation.

UNIT- IV
Process Management: Introduction to Agile practice, significance of team work, importance of communication in engineering profession, project management tools, checklist, timeline, Gantt chart, significance of documentation.

UNIT -V
Engineering Ethics & Sustainability in Engineering: Identifying Engineering as a profession, significance of professional ethics, code of conduct for engineers, identifying ethical dimensions in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas.

Sustainability in Engineering: Introduction, sustainability leadership, life cycle assessment, carbon foot print.

Text Books:

1. Clive L. Dym, Patric Little, Elizabeth J Orwin, “Engineering Design: A project-based introduction”, 4th edition, Willey.
2. Matthew Python, “Arduino programming for beginners”, Independently published, 2020.
3. Patrick F. Dunn , “Measurement and data Analysis for engineering and science” , thirdedition, 2014.
4. Andrew Stellman, Jennifer Greene, “Head First Agile: A brain-friendly guide to Agile principles, ideas, and real-world practices”, Kindle Edition.

Professor and Head Department
Department of Computer Science & Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075 (T.S.)

Suggested Reading:

1. Charles B. Fleddermann, “Engineering ethics”, fourth edition, Prentice Hall, 2012.
2. Rob Lawlor, “Engineering in society”, second edition, Royal academy of engineering.
3. Richard Dodds, Roger Venables, “Engineering for sustainable development: Guiding principles”, The Royal Academy of engineering, 2005.
4. Richard S. Paul, “Robot Manipulators: Mathematics, Programming, and Control”, MIT Press.

ENGINEERING EXPLORATION ASSESSMENT SCHEME				
S. No	**Name of the module**	**Work Hours**	**Marks**	**Evaluation**
1	Role of Engineers	4	-	Evaluation - I
2	Engineering Design	16	5	
3	Mechanisms	6	3	
4	Engineering Ethics	2	2	
5	Platform-based Development	16	5	Evaluation - II
6	Data Acquisition and Analysis	6	4	Evaluation-III
7	Project Management	4	4	
8	Sustainability in Engineering	6	2	
9	Course Project Reviews	12	20	Final Evaluation
10	Code of conduct	-	5	
	Total	**72**	**50**	

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Model Curriculum

B.E Syllabus for III and IV Semester

With effect from 2019-20

Specialization /Branch: Computer Science and Engineering

Chaitanya Bharathi Institute of Technology (A)
Chaitanya Bharathi (P.O), Gandipet
Hyderabad-500075, Telangana State.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTION AND EXAMINATION
III-Semester of B.E, Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER – III

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
THEORY									
1.	18EEC01	Basic Electrical Engineering	3	1	0	3	30	70	4
2.	18CSC07	Data Structures	3	0	0	3	30	70	3
3.	18CSC08	Discrete Mathematics	3	1	0	3	30	70	4
4.	18CSC09	Digital Electronics and Logic Design	3	0	0	3	30	70	3
5.	18MEC09	Principles of Management	3	0	0	3	30	70	3
6.	18CEM01	Environmental Science	2	0	0	2	-	50	0
PRACTICAL									
7.	18EEC02	Basic Electrical Engineering Lab	0	0	2	2	15	35	1
8.	18CSC10	Data Structures Lab	0	0	2	2	15	35	1
9.	18CSC11	Digital Electronics and Logic Design Lab	0	0	2	2	15	35	1
10.	18EGC03	Soft Skills	0	0	2	2	15	35	1
TOTAL			**17**	**2**	**8**		**210**	**540**	**21**

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

18EE C01

BASIC ELECTRICAL ENGINEERING

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives: The objectives of this course are

1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.
3. To understand the basic concepts of Transformer.
4. To understand the basic concepts of DC machines and AC machines.
5. To know about different types of electrical wires and cables and to understand safety rules and methods of earthing.

Course Outcomes: On Successful completion of the course, students will be able to

1. Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits
2. Acquire the concepts of principle of operation of Transformers and DC machines
3. Acquire the concepts of principle of operation of DC machines and AC machines
4. Acquire the knowledge of electrical wiring and cables and electrical safety precautions
5. Recognize importance of earthing and methods of earthing and electrical installations

UNIT-I: DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of firstorder RL and RC circuits.

UNIT-II: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III: Transformers

Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation, Auto transformer.

UNIT-IV: DC and AC Machines

DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators. DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors. Three - Phase Induction Motors: Construction, Principle of operation, Torque equation, torque-slip characteristics, Power stages, speed control of induction motors.

UNIT-V: Electrical Installations and Electrical Wiring

Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules.

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Earthing, Elementary calculations for energy consumption.

Text books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, –Basic Electrical Engineering Tata McGraw Hill, 2010.
2. V. D. Toro, –Electrical Engineering Fundamentals Prentice Hall India, 1989.
3. D.C. Kulshreshtha, –Basic Electrical Engineering McGraw Hill,2009
4. P.V.Prasad, S.sivanagaraju, R.Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013.

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18CS C07

DATA STRUCTURES

Instruction	3 Hours perweek
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives: The objectives of this course are
1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different balanced binary trees, which provides efficient implementation for data structures.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basic concepts of data structures.
2. Analyze the performance of algorithms.
3. Distinguish between linear and non-linear data structures.
4. Identify the significance of balanced search trees.
5. Establish a suitable data structure for real world applications.

UNIT - I

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff. **Recursion**: Introduction, format of recursive functions, recursion Vs. Iteration, examples. **Sorting:** Quick sort, Merge Sort, Selection Sort

UNIT - II

Linked Lists: Introduction, Linked lists, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays, Types of Linked Lists and operations-Circular Single Linked List, Double Linked List, Circular Double Linked List

UNIT- III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications

UNIT - IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Binary Trees, Tree Traversal. **Binary Search Trees:** Representation and operations. **Heap Tree:** definition, representation, Heap Sort. **Graphs:** Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.

UNIT - V

Hashing: Introduction, Hashing Functions- Modulo, Middle of Square, Folding, Collision Techniques-Linear Probing, Quadratic Probing, Double Hashing, **Balanced Search Trees:** AVL Trees, Red-Black Trees, Splay Trees, B-Trees

Text Books:
1. Narasimha karumanchi, "Data Structures and Algorithms Made Easy", Career Monk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, "Fundamentals of Data structures in C", E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, "Data Structures using C", Oxford University Press.

Suggested Reading:
1. D.S.Kushwaha and A.K.Misra, "Data structures A Programming Approach with C", PHI.
2. Seymour Lipschutz, "Data Structures with C", Schaums Outlines, Kindle Edition

Online Resources:
1. https://www.tutorialspoint.com/data_structures_algorithms/ index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data- structures-1#DS

18CS C08

DISCRETE MATHEMATICS

Instruction	3L+1T Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objectives of this course are

1. To provide theoretical foundations of computer sciences.
2. To develop an understanding of logic, set theory, counting, functions, relations and proof techniques.
3. To familiarize with algebraic systems and graph theory.

Course Outcomes: On Successful completion of this course, student will be able to

1. Apply Propositional and Predicate logic for problem solving in various domains.
2. Understand Set Theory, Relations, Functions and Lattices as partially ordered sets.
3. Model and solve the real world problems using Generating Functions and Recurrence Relations.
4. Understand and apply the principles of graphs and trees to simple applications.
5. Study Algebraic systems and their general Properties.

UNIT - I

Fundamental Principles of counting: The Rules of Sum and Product, permutations, Combinations. **Introduction to Propositional Calculus**: Basic Connectives and Truth tables, Logical Equivalence: Laws of Logic, Logical Implication; Rules of Inference. **Predicates**: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.

UNIT - II

Sets: Sets and Subsets, Operations on sets and the Laws of Set Theory, Counting and Venn Diagrams. **Relations and Functions:** Cartesian Products and Relations, Functions: Composition of functions, one-one, Onto and Inverse of functions, Pigeon hole principle, partial ordering relations, POSET, Hasse diagrams, Lattices as Partially Ordered Sets, Equivalence relations.

UNIT- III

Generating Functions: Binomial Theorem, Generating Functions, Calculating Coefficient of generating functions.
Recurrence Relations: The First Order Linear Recurrence Relation, Second Order Linear. Homogeneous Recurrence relations with constant coefficients, Non Homogeneous Recurrence relations

UNIT - IV

Introduction to Graphs: Graphs and their basic properties - degree, path, cycle, Sub graphs, Complements and Graph Isomorphism, Euler trails and circuits, Hamiltonian paths and cycles, planar graphs, Euler formula, Graph Coloring and Chromatic polynomial. **Trees**: Definitions, Properties, Rooted Trees, Spanning Trees, Minimum Spanning trees: The Algorithms of Kruskal and Prims.

UNIT - V

Algebraic Structures: Algebraic Systems: Examples and General Properties, Semi groups and Monoids. **Groups:** Definitions and Examples, Subgroups, Homomorphisms and cyclic groups.

Text Books:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", An Applied Introduction, 4th edition, Pearson Education, 2003.
2. R.K.Bisht, H.S.Dhami, "Discrete Mathematics", Oxford University Press, Published in 2015.

Suggested Reading:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th edition, Tata McGraw-Hill, 2005
2. J.P. Tremblay, R.Manohar, "Discrete Mathematical Structures with Applications to Computer Science", TATA McGraw-Hill Edition, 1995.
3. Joe L.Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists & Mathematicians", 2nd Edition, PHI, 1986.
4. David D.Railey, Kenny A. Hunt, "Computational Thinking for the Modern Problem Solving", CRC Press, 2014.

Online Resources:

1. https://nptel.ac.in/courses/111107058/
2. https://nptel-discrete-mathematics-5217

18CS C09

DIGITAL ELECTRONICS AND LOGIC DESIGN

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To understand the architecture of basic building blocks, logic gates and minimization techniques including Quine-Mcclusky method.
2. To analyze and design the Combinational and Sequential circuits.
3. To familiarize the notations of HDL descriptions in Verilog.

Course Outcomes: On Successful completion of this course, student will be able to

1. Familiarize with number systems, simplification of Boolean functions.
2. Manipulate simple Boolean expressions using maps and tabulation method.
3. Design basic digital circuits in Computer Hardware and Digital system.
4. Use high level HDLs such as Verilog for the design of Combinational and Sequential circuits.
5. Configure registers and counters for different applications.

UNIT - I

Digital Systems and Binary Numbers: Digital systems, Binary numbers, Number base conversions, Octal and Hexadecimal numbers, Complements of Numbers, Binary codes. **Boolean Algebra and logic Gates:** Binary logic, Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates, Integrated Circuits.

UNIT - II

Minimization of Switching Functions: Introduction, the map method, minimal functions and their properties, the tabulation procedure, the prime implicant chart. **NAND and NOR Gates**: NAND Circuits, Two-level Implementation, Multilevel NAND Circuits, NOR Circuits. **Exclusive OR Gates**: Odd Function, Parity Generation and Checking.

UNIT- III

Combinational Logic Design: Combinational Circuits. **Analysis Procedure:** Derivation of Boolean Functions, Derivation of the Truth Table, Logic Simulation. **Design Procedure:** Decoders, Encoders, Multiplexers, Binary Adders, Adder- Subtractor, Binary Multiplier, HDL Representations – Verilog.

UNIT - IV

Sequential Circuits: Sequential circuit definitions, Latches, Flip-Flops, sequential circuit analysis, sequential circuit design, design with D Flip-Flops, designing with JK Flip-Flops, HDL representation for sequential circuits - Verilog.

UNIT - V

Registers: Registers, Shift registers. **Counters**: Ripple Counters, Synchronous Binary counters, Other Counters. **Memory and Programmable Logic**: Introduction, Random-Access Memory, Memory Decoding, Error Detection and Correction, Read-Only Memory, Programmable Logic Array (PLA), Programmable Array Logic (PAL).

Text Books:

1. Morris Mano M. and Michael D.Ciletti, "Digital Design, With an Introduction to Verilog HDL", Pearson 5th edition, 2013.
2. ZVI Kohavi, "Switching and Finite Automata Theory", Tata McGraw Hill 2 edition, 1995.

Suggested Reading:

1. H.T. Nagle, "Introduction to Computer logic", Prentice Hall 1975.
2. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic with VHDL design, McGraw Hill 2nd Edition, 2009.

18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are to
1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

Course Outcomes: On Successful completion of this course, student will be able to
1. Get an exposure to common electrical components and their ratings
2. Make electrical connections by wires of appropriate ratings
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer
6. Understand the basic characteristics of dc and ac machines

UNIT - I

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, companies, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT - II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT- III

Organizing: Nature and purpose of Organizing, formal and informal organizations, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT - IV

Directing: Individual and group behavior, motivation, theories of motivation, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT - V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, "Management", 10/e., Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, "Management", 6/e., Pearson Education, 2004.

Suggested Reading:

1. P.C. Tripathy & P.N. Reddy, "Principles of Management", Tata McGraw Hill, 1999
2. Harold Koontz and Cyril O'Donnell "Principles of Management", Tata McGraw Hill, 2017

Professor and Head Department

18CE M01

ENVIRONMENTAL SCIENCE
(MANDATORY COURSE)

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: The objectives of this course are

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance.
3. To identify the importance of interlinking of food chain.
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: On successful completion of this course, student will be able to

1. Define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. Relate the social issues and the environment and contribute for the sustainable development.
4. Follow the environmental ethics.
5. Contribute for the mitigation and management of environmental disasters.

UNIT - I

Environmental Studies: Definition, Scope And Importance, Need For Public Awareness. Natural resources: Use And Over Utilization of Natural Resources - Water Resources, Food Resources, Forest Resources, Mineral Resources, Energy Resources, Land Resources.

UNIT - II

Ecosystems: Concept of an Ecosystem, Structure And Function of an Ecosystem, Role of Producers, Consumers And Decomposers, Energy Flow in an Ecosystem, Food Chains, Food Webs, Ecological Pyramids, Nutrient Cycling, Bio-Geo Chemical Cycles, Terrestrial And Aquatic Acosystems.

UNIT- III

Biodiversity: Genetic, Species And Ecosystem Biodiversity, Bio-Geographical Classification of India, India as a Mega Diversity Nation. Values of Biodiversity, Hot-Spots of Biodiversity, Threats to Biodiversity, Endangered And Endemic Species of India, Methods of Conservation of Biodiversity

UNIT - IV

Environmental Pollution: Cause, Effects And Control Measures of Air Pollution, Water Pollution, Marine Pollution, Soil Pollution, Noise Pollution And Solid Waste Management, Nuclear Hazards. Environmental Legislations: Environment Protection Act, Air, Water, Forest & Wild Life Acts, Issues Involved in Enforcement of Environmental Legislation, Responsibilities of State And Central Pollution Control Boards.

UNIT - V

Social issues and the environment: Water Conservation Methods: Rain Water Harvesting And Watershed Management, Environmental Ethics, Sustainable Development and Climate Change: Global Warming, Ozone Layer Depletion, Forest Fires, And Contemporary Issues.

Text Books:

1. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria& Sons, 2009.

Suggested Reading:

3. C. S. Rao," Environmental Pollution Control Engineering", Wiley, 1991.
4. S. S. Dara, "A Text Book of Environmental Chemistry &Pollution Control", S. Chand Limited, 2006.

18EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives: The objectives of this course are
1. To verify the basic electrical circuit laws and theorems.
2. To determine the parameters and power factor of a coil.
3. To calculate the time and frequency responses of RLC circuits
4. To determine the characteristics of Transformers.
5. To determine the characteristics of dc and ac machines.

Course Outcomes: On Successful completion of the course, students will be able to
1. Make electrical connections by wires of appropriate ratings.
2. Understand the circuit analysis techniques.
3. Determine the parameters of the given coil.
4. Understand the basic characteristics of transformer.
5. Understand the basic characteristics of dc and ac machines.

List of Laboratory Experiments/Demonstrations:
1. Demonstration of Measuring Instruments and Electrical Lab components
2. Verification of KCL and KVL.
3. Time response of RL and RC circuits.
4. Calculation of parameters of a choke coil by Wattmeter Method.
5. Verification of Thevenin's and Norton's theorems.
6. Turns ratio /voltage ratio verification of 1-Ph Transformers.
7. OC and SC tests on a given 1-Ph Transformer.
8. Observation of Excitation Phenomenon in Transformer.
9. Measurement of 3-Ph power in a balanced system (By 2- Wattmeter method).
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle).
11. Load test of DC Shunt motor.
12. Speed control of DC Shunt motor.
13. Load test of 3-Ph Induction motor.
14. Demonstration of LT Switchgear Equipment/Components.
15. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: At least **TEN** experiments should be conducted in the semester.

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18CS C10

DATA STRUCTURES LAB

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Pre-requisites: Any Programming Language(C/Python)

Course Objectives: The objectives of this course are to:
1. Understand basic concepts data structures and abstract data types.
2. Differentiate between linear and non-linear data structures.
3. Analyze various searching, sorting and hashing techniques.

Course Outcomes: On Successful completion of the course, students will be able to
1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Implement non-linear data structures such as trees, graphs.
4. Analyze various searching and sorting techniques.
5. Design and develop real world problem using suitable data structures.

List of Experiments
1. Implementation of Quick Sort, Merge Sort, Selection Sort.
2. Implementation of Insert, Delete and Search operations on Single Linked List.
3. Implementation of Insert, Delete and Search operations on doubly Linked List.
4. Implementation of Stack using array and linked list.
5. Converting of Infix Expression to Postfix.
6. Implement the algorithm for Evaluation of Postfix.
7. Implementation of Queue using array and linked list.
8. Implementation of Binary Tree Traversals.
9. Implementation of Binary Search Tree.
10. Implementation of Heap Sort.
11. Implementation of Graph Traversal Techniques.
12. Implementation of Hashing.

Text Books
1. Brian W Kernighan, Dennis Ritchie, "C Programming Language", PH PTR, 2nd Edition.
2. Richard M Reese, "Understanding and Using C Pointers", O`Reily, 2013.

Online Resources:
1. https://nptel.ac.in/courses/106102064/
2. https://www.udemy.com/algorithms-and-data-structures-in-python/

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18CS C11

DIGITAL ELECTRONICS AND LOGIC DESIGN LAB

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The objectives of this course are
1. To simulate and synthesize combinational logic circuits.
2. To simulate and synthesize sequential logic circuits.
3. To write a test bench for verifying the functionality and implement procedures for any digital design.

Course Outcomes: On Successful completion of this course, student will be able to
1. Design a Digital circuit using Verilog HDL.
2. Understand various abstraction levels of a digital design.
3. Verify the functionality of a design using Test bench.
4. Simulate and synthesize combinational logic circuits.
5. Simulate and synthesize sequential logic circuits.

Write a Verilog HDL to Simulate and synthesize the following
1. Implement operators and operands using Verilog.
2. Logic Gates: AND, OR, BUFFER.
3. Arithmetic Units: Adders and Subtractors.
4. Magnitude Comparator, BCD to Excess 3, BCD to 7-segment display.
5. Multiplexers and De-multiplexers.
6. Encoders, Decoders, Priority Encoder.
7. Implementation of logic function using Multiplexers and Decoders.
8. Implementation of Ripple Carry Adder.
9. Flip-Flops.
10. Design of Synchronous Counters.

Text Book:
1. Samir Palnitkar, "Verilog HDL, A guide to Digital design and synthesis", 2/e, Pearson Education, 2008.

Suggested Reading:
1. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL", PHI, 2005.

18EG C03

SOFT SKILLS

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The objectives of this course are:

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: On Successful completion of the course, students will be able to

1. Be effective communicators and participate in group discussions and case studies with confidence. Also be able to make presentations in a professional context.
2. Write Resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
4. Make the transition smoothly from Campus to Corporate. Also use media with etiquette and know what academic ethics are.
5. To do a live, mini project by collecting and analyzing data and making oral and written presentation of the same.

Exercise 1

Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.

Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion),

Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise).

Exercise 2

Main Topics: Advanced Group Discussion with Case studies: Dynamics of group discussion, intervention, summarizing and modulation of voice, body language, relevance, fluency and coherence. **Flipped Sessions:** Importance of Professional Updating & Upgrading (Reading & Discussions).**Writing Input:** Writing with Precision - Writing Abstracts.

Exercise 3

Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.

Flipped Sessions: Mock Interviews (Video Sessions &Practice), **Writing Input:**
Writing to Reflect - Resume Writing.

Exercise 4

Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity, **Flipped Sessions:** Corporate Culture, Etiquette & Grooming (Video Sessions and Practice through Role-play), **Writing Input:** Writing to Define - Writing an effective SOP.

Exercise 5

Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar.Elements and Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props and PPT.

Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation), **Writing Input:** Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007.
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006.
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010.
4. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004.
5. Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

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20CAC02

FUNDAMENTALS OF DATA SCIENCE LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-Requisites: Probability and Statistics

Course Objectives: The objectives of this course are
1. Understand the significance of data science tools.
2. Apply statistical methods to implement various functionalities.
3. Apply exploratory data analytical techniques to deal with single and multiple variables.

Course Outcomes: On successful completion of this course, Student will be able to:
1. Understand the significance of data science tools.
2. Apply statistical methods to implement functionalities in Numpy, Scipy, Pandas packages.
3. Analyze the significance of Inferential Statistics.
4. Apply Exploratory Data Analytical Techniques to visualize Single variable.
5. Apply Exploratory Data Analytical Techniques to visualize Multiple variables.
6. Analyze the significance of Time Series Forecasting.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	2	1	1	1	1	-	-	-	-	-	1	-	1	1	-	1
CO 2	3	2	-	2	-	-	-	-	-	-	-	-	1	1	-	1
CO 3	3	2	-	2	-	-	-	-	-	-	-	-	1	1	-	1
CO 4	3	1	-	2	-	-	-	-	-	-	-	-	1	1	-	-
CO 5	3	1	-	2	-	-	-	-	-	-	-	-	1	1	-	-
CO 6	3	2	-	2	-	-	-	-	-	-	-	-	1	1	-	1

List of Experiments
1. Identification and Installation of required softwares/Technologies (python/modules).
2. Implementation of statistical methods in Numpy.
3. Implementation of statistical methods in Scipy.
4. Implementation of statistical methods in Pandas.
5. Demonstration of Inferential Statistics-sampling.
6. Demonstration of Hypothesis testing-variants of t-test.
7. Demonstration of statistical methods Anova.
8. Time Series Forecasting with ARIMA model.

Text Books:

1. EMC Education Services “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley Publishers, 2012.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.
3. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd ed.

Suggested Readings:

1. JojoMoolayil, “Smarter Decisions: The Intersection of IoT and Data Science”, PACKT, 2016.
2. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013.
3. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.
4. Hastie, Trevor, et al., “The elements of statistical learning: Data Mining, Inference, and Prediction”, Vol. 2. No. 1. New York: Springer, 2009.

Online Resources:
1. https://www.topcoder.com/role-of-statistics-in-data-science/
2. https://www.logianalytics.com/predictive-analytics/what-is-predictive-analytics/.
3. https://data-flair.training/blogs/

4. https://www.analyticsvidhya.com/blog/2016/02/time-series-forecasting-codes-python/
5. https://conjointly.com/kb/descriptive-statistics/

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20CAC01

FUNDAMENTALS OF DATA SCIENCE

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	2

Pre-requisites: Probability and Statistics

Course Objectives: The objectives of this course are
1. Understand the significance of data science concepts and tools in the modern world.
2. Apply various data science techniques relating to pre-processing, exploring and visualizing data.
3. Apply statistical and predictive analytical methods to deal with the real time data.

Course Outcomes: On successful completion of this course, Student will be able to:
1. Understand the significance of data science tools and techniques.
2. Apply data cleaning, transformation and discretization techniques.
3. Analyze various inferential statistics and time-series methods.
4. Understand and apply data visualization techniques.
5. Understand predictive analytics and its applications.
6. Apply data science techniques to deal with the real-world problems.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	2	1	1	1	1	-	-	-	-	-	1	-	1	1	-	1
CO 2	3	2	-	2	-	-	-	-	-	-	-	-	1	1	-	1
CO 3	3	2	-	2	-	-	-	-	-	-	-	-	1	1	-	1
CO 4	3	1	-	2	-	-	-	-	-	-	-	-	1	1	-	-
CO 5	3	1	-	2	-	-	-	-	-	-	-	-	1	1	-	-
CO 6	3	2	1	2	2	-	-	-	-	1	-	-	1	1	1	1

UNIT – I: Introduction

Introduction to Data Science: Evolution of Data Science, Data Science Roles, Life Cycle of Data Science Project, Applications of Data Science, Data Security Issues.
Data collection and types :primary, secondary, structured data, unstructured data.

UNIT – II: Data Pre-Processing

Data Pre-Processing Overview, **Data Cleaning:** Missing values, dealing with noisy data, Spread, outliers **Data Transformation & Discretization:** Transformation strategies overview, transformation by normalization, discretization by binning, Dimensionality Reduction.

UNIT – III: Exploratory Data Analytics

Organizing Data : Variables and data, organizing Qualitative data, organizing Quantitative data**Introduction to Frequency Tables and Graphs:** Line Graphs, Bar Graphs, Frequency Polygons, Relative Frequency Graphs, Pie Charts, Grouped Data and Histograms, Stem and leaf Plots, sets of paired data.
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UNIT – IV: Statistical Analysis

Statistical Methods for Evaluation: Random Variables, Expected Values, Variance of Random Variables, Distribution of Sampling Statistics, population mean, Testing Statistical Hypothesis: Hypothesis testsand significance levels, t-test, Wilcoxon Rank-Sum Test, ANOVA.

UNIT – V: Real-time Applications of Data Science

Introduction to predictive analytics, applications of predictive analytics, Data science for recommendation systems, data science for healthcare, data science for educational systems.

Text Books:
1. EMC Education Services "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publishers, 2012.

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2. Neil A.Weiss, "Introductory Statistics", 10th Edition, Pearson Education Limited, 2017.
3. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd ed.

Suggested Reading:

1. JojoMoolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.
2. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013.
3. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.
4. Hastie, Trevor, et al., “The elements of statistical learning: Data Mining, Inference, and Prediction”, Vol. 2. No. 1. New York: Springer, 2009.
5. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.

Online Resources:

1. https://www.topcoder.com/role-of-statistics-in-data-science/
2. https://www.logianalytics.com/predictive-analytics/what-is-predictive-analytics/.
3. https://data-flair.training/blogs/
4. https://www.analyticsvidhya.com/blog/2016/02/time-series-forecasting-codes-python/
5. https://conjointly.com/kb/descriptive-statistics/
6. https://www.udemy.com/course/datascience-statistics/
7. https://www.google.co.in/books/edition/Introductory_Statistics/c838DAAAQBAJ?hl=en&gbpv=1&pg=PA2&printsec=frontcover

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION
IV-Semester of B.E, Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER – IV

S.No	Course Code	Title of the Course	Scheme of Instruction				Scheme of Examination		
			Hours per week			Duration of SEE in Hours	Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
THEORY									
1	18ECC34	Basic Electronics	3	-	-	3	30	70	3
2	18MTC09	Probability and Statistics	3	1	-	3	30	70	4
3	18CSC12	Computer Architecture and Micro Processor	3	-	-	3	30	70	3
4	18CSC13	Data Base Management Systems	3	-	-	3	30	70	3
5	18EGM01	Indian Constitution and Fundamental Principles	2	-	-	2	-	* 50	0
PRACTICALS									
6	18ECC35	Basic Electronics Lab	-	-	2	2	15	35	1
7	18CSC14	Computer Architecture and Micro Processor Lab	-	-	3	3	25	50	1.5
8	18CSC15	Data Base Management Systems Lab	-	-	3	3	25	50	1.5
9	18CSC16	IT Workshop (Latex/Scilab)	-	1	2	3	25	50	2
		TOTAL	**14**	**2**	**10**	**-**	**210**	**515**	**19**

L: Lecture D: Drawing CIE - Continuous Internal Evaluation
T: Tutorial P: Practical SEE - Semester End Examination

18ECC34

BASIC ELECTRONICS

Instruction	3 L Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge about semiconductor physics and basic electrical engineering.

Course Objectives: The objectives of this course are
1. Describe semiconductor devices principle and to understand the characteristics of junction diode and transistors.
2. Understand working principles of Oscillators and Amplifiers.
3. Understand the working principle of the regulators and transducers.

Course Outcomes: On Successful completion of the course, students will be able to
1. Use semiconductor devices in making circuits like rectifiers, filters, regulators etc.
2. Design amplifier and oscillators
3. Compare various types of power amplifiers.
4. Analyze the principles and practices for instrument design to development the real world Problems.
5. Apply concepts of various electronic circuits.

UNIT – I
Semiconductor Theory: Energy levels, Intrinsic and Extrinsic Semiconductor, Mobility, Diffusion and Drift current, Hall effect, Law of mass action, Characteristics of P-N Junction diode, current equation, Parameters and Applications. **Rectifiers:** Half wave and Full wave Rectifiers Bridge and center tapped with and without filters, Ripple factor, regulation and efficiency.

UNIT – II
Transistors: Bipolar and field effect transistors with their h-parameter equivalent circuits, Basic Amplifiers classification and their circuits (Qualitative treatment only). **Regulators and Inverters**: Zener Diode**,** Breakdown mechanisms, Characteristics, Effect of Temperature, Application as voltage regulator.

UNIT – III
Feedback Amplifiers: Properties of Negative Feedback Amplifier, Types of Negative Feedback, Effect of negative feedback on Input impedance and Output impedance, Applications (Qualitative treatment only).
Oscillators: principle of oscillations, LC Type-Hartley, Colpitt and RC Type- Phase shift, Wien Bridge and Crystal Oscillator (Qualitative treatment only).

UNIT – IV
Operational Amplifiers: Basic Principle, Ideal and practical Characteristics and Applications-Summer, Integrator, Differentiator, Instrumentation Amplifier. **Power Amplifiers:** Operation of Class A, Class B, Class AB and Class C power amplifiers

UNIT – V
Data Acquisition systems: Study of transducers-LVDT, Strain gauge. **Photo Electric Devices and Industrial Devices:** Photo diode, Photo Transistor, LED, LCD, SCR, UJT Construction and Characteristics and their applications only. **Display Systems:** Constructional details of C.R.O and Applications.

Text Books:
1. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuits Theory", Pearson Education, 9thedition, LPE, Reprinted, 2006.
2. Morris Mano, "Digital Design", Pearson Education, Asia 2002.

Suggested Reading:
1. Jacob Millman and C., Halkias, "Electronic Devices", McGraw Hill, Eight Edition, Reprint1985.
2. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Prentice Hall of India, 3rd edition,1985.
3. W. D. Cooper, A. Helfric, "Electronic Instrumentation and Measurement Techniques", PHI, 4th edition,2010.

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18MT C09

PROBABILITY AND STATISTICS
(For CSE and IT)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objectives of this course are
1. To Able to learn and Analyzing data in Linear and Non-Linear form.
2. To Able to fit the hypothetical data using probability distribution.
3. To Understand the data using the testing of Hypothesis.
4. To Able to Analyzing time series data using trend analysis.
5. To Able to formulate and get the solution of real world problem.

Course Outcomes: On Successful completion of the course, students will be able to
1. Use the principle of Least Squares approximating for estimating the value.
2. Use the basic probability for fitting the Random phenomenon.
3. Analyzing data using different methods of hypothesis testing.
4. Use the Moving Averages Methods for trend analysis.
5. Analyze the random phenomena of real world data.

UNIT – I
Basic Statistics: Measures of Central Tendency, Measures of Dispersion, Skewness (SKP & SKB) For Frequency Distribution, Kurtosis, Curve Fitting by The Method of Least Squares, Fitting of Straight Lines, Second Degree Parabola And Growth Curve. ($y = ae^{bx}, y = ax^b$ &$y = ab^x$.)

UNIT – II
Discrete Probability Distributions: Basic Probability, Conditional Probability, Bayes Theorem, Random Variable, Discrete Random Variable, Continuous Random Variable, Properties of Probability Mass Function, Probability Density Function, Mathematical Expectation Variance, Co-Variance And Properties, Poisson Distribution, MGF, CGF, Fitting of Poisson Distribution.

UNIT – III
Continuous Probability Distribution And Bivariate Distribution: Continuous Probability Distribution-Normal Distribution-Standard Normal Random Variable (MGF, Expectation, Variance, Properties of Normal Curve)-Areas Under Normal Curve-Exponential Distribution (MGF, CGF, Expectation, Variance)-Uniform Distribution (MGF, Expectation, Variance)-Bivariate Data Two Dimensional Discrete Random Variable, Continuous Random Variable, Marginal Probability Function, Properties of Joint Probability Function-Sum And Differences.

UNIT – IV
Small Sample Test: Inferential Statistics-Test of Significance-Large Sample Test For Single Proportion, Difference of Proportions, Single Mean, Difference of Means And Differences of Standard Deviations. Small Sample Test-Test For Single Mean, Differences of Means, Test For Ratio of Variances, Chi-Square Test For Goodness of Fit And Independent of Attributes.

UNIT – V
Time Series Analysis and ANOVA: One Way Classification-Assumptions For ANOVA Test-ANOVA For Fixed Effect Model-Two Way Classification-ANOVA For Fixed Effect Model-Components of Time Series-Measurement of Trend - Method of Semi Averages- Moving Averages Method (3 Years And 5 Years).

Text Books:

1. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.
2. S.C.Gupta, V.K.Kappoor, "Fundamentals of Applied Statistics", Sultan Chand and Sons, 2014.
3. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

Suggested Reading:

1. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, 3rd Ed., Wiley, 1968.

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18CS C12

COMPUTER ARCHITECTURE AND MICRO PROCESSOR

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Digital Electronics and Logic Design.

Course Objectives: The objectives of this course are
1. To understand the basic principles of Instruction Level Architecture and Instruction Execution, Memory System Design.
2. To learn various I/O devices and its operations, knowledge on Instruction Level Parallelism.
3. To impart the knowledge on Micro Programming and Pipelining techniques.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand the functional block diagram of single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
2. Design assembly language program for specified computing 16 bit multiplication, division and I/O device interface.
3. Derive flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
4. Design a memory module and analyze its operation by interfacing with the CPU.
5. Apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

UNIT - I
Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi-computers. **Arithmetic:** Addition and Subtraction of Signed numbers, Design of fast adders, Multiplication of positive numbers, Signed-Operand Multiplication, Integer Division.

UNIT - II
Basic Processing Unit: Fundamental concepts, Execution of a complete instruction, Multiple-Bus organization, Hardwired control, Micro programmed control. **8086 Architecture:** CPU Architecture, Internal operation, Machine language instructions Addressing modes, Instruction formats, Instruction execution timing.

UNIT- III
Assembly Language Programming: Instruction format, Data transfer instructions, Arithmetic instructions. **Assembly Language Programming:** Branch instructions, Loop instructions, NOP and HLT, Flag manipulation instructions, Logical instructions, Shift and Rotate instructions, Directives and Operators. **Modular Programming:** Linking and Relocation, Stacks, Procedures, Interrupts and Interrupt routines, Macros and String instructions, REP prefix.

UNIT - IV
Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers –Program Controlled, Interrupt Driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCSI, USB.
Pipelining: Basic concepts, Data hazards, Instruction hazards, Influence on instruction sets, Data path and control considerations, Superscalar operation, Performance considerations.

UNIT – V
The Memory System: Semiconductor RAM Memories, Cache Memories, Performance considerations, Virtual Memories, Memory Management requirements, Secondary Storage. **Large Computer Systems:** Forms of Parallel Processing, Array Processors, Structure of general purpose multiprocessors, Program parallelism and shared variables.

Text Books:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, “Computer Organization”, 5th Edition, McGrawHill Education Edition 2011.
2. Yu-chengLiu, Glenn A.Gibson, “Microcomputer Systems: The 8086/ 8088 Family”, 2nd Edition, PHI Learning 2011.

Suggested Reading:

1. M. M. Mano, “Computer System Architecture”, 3rd edition, Prentice Hall, 1994.
2. William Stallings, “Computer Organisation and Architecture, Design for Performance”, Pearson, 9th Edition, 2013.
3. Douglas Hall. “Microprocessor and Interfacing programming and Hardware”, Tata McGraw Hill, Revised 2nd Edition, 2007.
4. Brey B.Brey, “The Intel Microprocessor, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro-Processors-Architecture, Programming and Interfacing”, 4thEdition, Prentice Hall.

18CS C13

DATABASE MANAGEMENT SYSTEMS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Discrete mathematics of computer science, Programming and data structures.

Course Objectives: The objectives of this course are

1. To become familiar with fundamental concepts of database management. These concepts include aspects of database design, database languages and database-system implementation.
2. To understand about data storage techniques and indexing.
3. To impart knowledge in transaction management, concurrency control techniques and recovery procedures.

Course Outcomes: On Successful completion of this course, student will be able to

1. Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS.
2. Design the database using ER modeling and Write queries using DDL, DML and DCL of SQL, Relational Algebra and Procedures, Functions using PL/SQL
3. Outline the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.
4. Summarize basic concepts of storage techniques like indexing, hashing and familiar with states and properties of transaction.
5. Illustrate locking, time stamp, graph and validation-based protocols for concurrency control.
6. Relate log based, ARIES recovery techniques to increase the robustness of the database, identify to resolve the deadlocks in the transaction.

UNIT - I

Introduction : Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Users and Administrators, Database System Architecture, Application Architectures.

Database Design and E-R Model: Overview of the Design Process, Data Models, The E-R Model, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Reduction to Relation Schemas.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations.

Structured Query Language: Overviews, SQL Data Types, Basic Structure of SQL Queries, Modification of the Database, Set Operations, Aggregate Functions, Data-Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT- III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization–1NF,2NF and 3 NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

Indexing: Basic Concepts, Primary Index, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files.

UNIT - IV

Hash based Indexing: Static Hashing, Extendible Hashing. **Transaction Management and Concurrency Control:** Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity.

UNIT - V

Deadlocks: Deadlock Prevention, Deadlock Detection and Recovery. **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, ARIES Recovery Method, Remote Backup Systems.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, “An Introduction to Database Systems”, Eight Editions, Pearson Education, 2006.
3. Raghu Ramakrishnan, Johnnes Gehrke, “Database Management Systems”, Third Edition, McGraw Hill, 2003.
4. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, “Fundamentals of Database Systems”, Fourth Edition, Pearson Education, 2006.

Suggested Reading:

1. J.D.Ullman, “Principles of Database Systems”, Galgotia.

Online Resources:

1. http://www.nptelvideos.in/2012/11/database-management- system.html

Professor and Head Department

18EG M01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks
CIE	-
Credits	-

Course Objectives: The objectives of this course are
1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand the making of the Indian Constitution, its features and know the importance of Directive Principles of State Policy.
2. Identify the difference between Right to Equality and Right to Freedom and acquires the legal status of Fundamental Duties.
3. Analyze the structuring of the Indian Union, distribution of powers between the Union and the States, and the role and position of President in Union Government.
4. Distinguish between the Lok Sabha and Rajya Sabha in law making while appreciating the importance of Judiciary in interpretation of law.
5. Differentiate between the Municipalities and Panchayats in their structure and functions.
6. Apply the knowledge of Indian Constitution to real-life or professional situation for better civic society

UNIT - I

Constitution of India: Introduction and salient features, Constitutional history, Directive principles of state policy - Its importance and implementation.

UNIT - II

Union Government and its Administration: Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States, Parliamentary form of government in India. **President**: role, power and position.

UNIT- III

Emergency Provisions in India: National emergency, President rule, Financial emergency

UNIT – IV

Local Self Government: District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

UNIT – V

Scheme of the Fundamental Rights & Duties: Fundamental Duties - the legal status.

Scheme of the Fundamental Rights: To Equality, to certain Freedom under Article 19, to Life and Personal Liberty under Article 21.

Text Books:
1. Indian Government & Politics, Ed Prof V Ravindra Sastry, Telugu Akademy, 2nd edition, 2018.
2. Indian Constitution at Work, NCERT, 10th edition, 2018.

Suggested Reading:
1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition,2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Online Resources:
1. http://www.nptel.ac.in/courses/103107084/Script.pdf

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18EC C35

BASIC ELECTRONICS LAB

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Prerequisite: Knowledge about semiconductor physics and basic electrical engineering.

Course Objectives: The objectives of this course are
1. Learn about various electronic components and devices.
2. Study the transistor characteristics in different modes.
3. Learn about oscillators and amplifiers.

Course Outcomes: On Successful completion of the course, students will be able to
1. Familiarize on basic electronic components, devices and system.
2. Analyze the measurements of time period, amplitude and phase of different waveforms.
3. Design and analyze the behavior of the regulator and rectifier.
4. Develop various types of oscillators and power amplifiers
5. Design the various circuits using operational amplifiers.

LIST OF EXPERIMENTS:
1. Study of Electronic components.
2. Characteristics of Semiconductor diodes (Ge, Si and Zener).
3. CRO and its Applications.
4. Half, Full wave rectifiers with and without filters.
5. Voltage Regulator using zener diode.
6. Characteristics of BJT in CE Configuration.
7. Characteristics of FET in CS Configuration.
8. Amplifier with and without feedback.
9. RC Phase shift oscillator
10. Operational Amplifier and its applications.
11. Power Amplifiers Characteristics
12. Realization of Half and Full adder

Text Books:

1. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics, a Text - Lab Manual", 7th Edition, TMH, 1994.
2. Paul B. Zbar, "Industrial Electronics, a Text - Lab Manual", 4th Edition, 2008.

Professor and Head Department

18CS C14

COMPUTER ARCHITECTURE AND MICRO PROCESSOR LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Pre-requisites: Digital Electronics and Logic Design, Computer Architecture.

Course Objectives: The objectives of this course are
1. To become familiar with the architecture and Instruction set of 8086 microprocessor.
2. To provide practical hands on experience with Assembly Language Programming.
3. To provide solid foundation on interfacing the external devices to the processor according to the user requirements to create novel products and solutions for the real time problems.

Course Outcomes: On Successful completion of this course, student will be able to
1. Describe the architecture and comprehend the instruction set of 8086.
2. Understand and apply the principles of Assembly Language Programming in developing microprocessor based applications.
3. Get familiarized with different assembly language software tools.
4. Work with standard microprocessor interfaces to know how a processor will communicate with the External world.
5. Design and develop of various Embedded Applications.

LIST OF EXPERIMENTS:
1. Examining and understanding the working nature of internal components of computer like North bridge and South bridge of mother board, Memories like cache, ROM, RAM, Secondary storage devices, understanding CMOS and analyzing configuration using inbuilt or external tools.
2. Implementation of 2's complement to represent signed numbers in C/ Java/Python for a user specified bit length like 8/16 bit.
3. Implementation of Booth's Binary Multiplication algorithm in C/Java/ Python.
4. Implementation of Non restoring Division algorithm in C/Java/Python.
5. Tutorials with 8086 kit / MASM / NASM software tool.
6. Addition of 32-bit numbers using 16-bit registers.
7. Fixed-point multiplication and division.
8. Sorting hexadecimal array.
9. Code conversion from hexadecimal to decimal.
10. Packed and Unpacked BCD numbers.
11. Sum of set of BCD numbers.
12. Searching.
13. Display a string of characters using 8279.

Suggested Reading:

1. Yu-cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086/ 8088 Family", 2^{nd} Edition, PHI Learning 2011.
2. Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata McGraw Hill, Revised 2^{nd} Edition, 2007.
3. B. Brey, "The Intel Microprocessor, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro-Processors-Architecture, Programming and Interfacing", 4^{th} Edition, Prentice Hall, 1993.

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18CS C15

DATABASE MANAGEMENT SYSTEMS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Course Objectives: The objectives of this course are
1. To become familiar with the concepts of structured query language.
2. To understand about programming language / structured query language (PL/SQL).
3. To become familiar with generation of form and open database connectivity.

Course Outcomes: On Successful completion of this course, student will be able to
1. Apply the built-in functions and write simple queries on various databases.
2. Perform definition and manipulation of data using SQL commands.
3. Develop complex queries using joins and nested queries.
4. Add constraints on Databases implement DCL, TCL and advanced SQL commands.
5. Develop programs using cursors, triggers, exceptions, procedures and functions in PL/SQL.

LIST OF EXPERIMENTS:

SQL:
1. Queries using Built-In functions, like aggregate functions, String Functions, Numeric Functions, Data Functions, Conversion Functions and other miscellaneous.
2. Queries using operators in SQL.
3. Queries to Retrieve and Change Data: Select, Insert, Delete and Update.
4. Queries using Group By, Order By and Having Clauses.
5. Queries on Controlling Data: Commit, Rollback and Save point.
6. Queries to Build Report in SQL *PLUS.
7. Queries for Creating, Dropping and Altering Tables, Views and Constraints.
8. Queries on Joins and Correlated Sub-Queries.
9. Queries on Working with Index, Sequence, Synonym, Controlling Access and Locking Rows for Update, Creating Password and Security features.

PL/SQL:
1. Write a PL/SQL code using Basic Variable, Anchored Declarations and Usage of Assignment Operation.
2. Write a PL/SQL code Bind and Substitution Variables, Printing in PL/ SQL.
3. Write a PL/SQL block using SQL and Control Structures in PL/SQL.
4. Write a PL/SQL code using Cursors, Exception and Composite Data Types.
5. Write a PL/SQL code using Procedures, Functions and Packages.

Note: The creation of sample database for the purpose of the experiments is expected to be pre-decided by the instructor.

Text Books / Suggested Reading:

1. "Oracle: The complete Reference", by Oracle Press.
2. Nilesh Shah, "Databse Systems Using Oracle", PHI, 2007.
3. Rick F Van der Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007.

Professor and Head Department

18CS C16

IT WORKSHOP (Latex / Scilab)

Instruction	1T + 2P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course Objectives: The objectives of this course are
1. Familiarize the students with documentation and visualization tools like Latex and Scilab.
2. Development of proficiency in documentation for presentation and report writing.
3. Explore the utilities in Latex and Scilab.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the need of documentation tools.
2. Install the documentation tools.
3. Generate templates for generation report using Latex.
4. Generate templates for presentation using Beamer.
5. Explore the utilities of Scilab

LIST OF EXPERIMENTS:
1. Installation of Latex and Scilab.
2. Understanding Latex compilation, basic syntax, writing of equations, matrices, tables.
3. Page Layout –Titles, abstract, chapters, sections, references, equation, references, citation, table of contents, generating new commands, figure handling, numbering, list of figures, list of tables, generating index.
4. Packages: Geometry, hyperref, amsmath, amssymb, algorithms, algorithmic graphic, color, tiles listing.
5. Understanding of Classes: article, book, reports,
6. Beamer, slides preparation.
7. Writing Resume, question paper, articles, research papers, Presentation using beamer.
8. Basic syntax, Mathematical Operators, Predefined constants, Built in functions.
9. Scilab Programming: Functions, loops, conditional statements, handling .sci files.
10. Graphics handling: 2D, 3D, Generating .jpg files, function plotting, data plotting.
11. Solving linear equations, Eigen values and numerical analysis, iterative methods, ordinary differential equation, plotting solution curves,
12. Comparison OS Scilab with C / C++/ Matlab.

Text Books / Suggested Reading / Online Resources:
1. https://www.latex-project.org/help/documentation/
2. https://spoken-tutorial.org/tutorial ef,search?search_foss=LaTeX& search_language=English
3. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
4. https://www.scilab.org/tutorials\

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AICTE-Model Curriculum

B.E Syllabus for Semester V and VI

With effect from 2020 - 21

Specialization /Branch: Computer Science and Engineering

Chaitanya Bharathi Institute of Technology (A)

Chaitanya Bharathi (P.O), Gandipet

Hyderabad-500075, Telangana State.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

SCHEME OF INSTRUCTION AND EXAMINATION
V-Semester of B.E, Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-V

Sl.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18CSC17	Formal Language and Automata Theory	3	0	0	3	30	70	3
2	18CSC18	Operating System	3	0	0	3	30	70	3
3	18CSC19	Design and Analysis of Algorithms	3	0	0	3	30	70	3
4	18CSE XX	Professional Elective-I	3	0	0	3	30	70	3
5	18MTO XX	Open Elective-I	3	0	0	3	30	70	3
PRACTICALS									
6	18CSC20	Operating System Lab	0	0	3	3	25	50	1.5
7	18CSC21	Design and Analysis of Algorithms Lab	0	0	3	3	25	50	1.5
8	18CSE XX	Professional Elective-I Lab	0	0	3	3	25	50	1.5
9	18CSC22	Mini Project	0	0	3	-	50	-	1
		TOTAL	**15**	**0**	**12**		**275**	**500**	**20.5**

PROFESSIONAL ELECTIVE-I			OPEN ELECTIVE-I	
Course Code	**Title of the Course**		**Course Code**	**Title of the Course**
18CSE01	Web and Internet Technologies		18MTO 01	Decision Theory
18CSE02	GUI Programming		18MTO 02	Graph Theory
18CSE03	Image Processing		18MTO 03	Number Theory and Cryptography
18CSE04	Mobile Application Development		18MTO 04	Quantum Computing

PROFESSIONAL ELECTIVE-I LAB	
Course Code	**Title of the Course**
18CSE05	Web and Internet Technologies Lab
18CSE06	GUI Programming Lab
18CSE07	Image Processing Lab
18CSE08	Mobile Application Development Lab

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

18CSC17

FORMAL LANGUAGE AND AUTOMATA THEORY

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Discrete Mathematics, Data Structures, Algorithms.

Course Objectives: The objectives of this course are
1. Identify the hierarchy of formal languages, grammars and Design finite automata to accept a set of strings of a language.
2. Prove that a given language is regular and apply the closure properties of languages and design context free grammars, conversions into normal forms.
3. Equivalence of languages accepted by Push Down Automata and distinguish between computability and non-computability and Decidability and Undecidability.

Course Outcomes: On Successful completion of this course, student will be able to
1. Describe language basics like Alphabet, strings, grammars, productions, derivations, and Chomskyhierarchy.
2. Recognize regular expressions, formulate, and build equivalent finite automata for various languages.
3. Identify closure, decision properties of the languages and prove the membership.
4. Demonstrate context-free grammars, check the ambiguity of the grammars and design equivalent PDA to accept.
5. Use mathematical tools and abstract machine models to solve complex problems.
6. Distinguish between decidability and undecidability.

UNIT - I

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages**.** Regular languages and finite automata: Regular expressions and languages, Deterministic Finite Automata (DFA) and equivalence with regular expressions, Nondeterministic Finite Automata (NFA) and equivalence with DFA.

UNIT - II

Finite Automata and Regular Expression: From DFAs to Regular Expressions, Converting DFA's to Regular Expressions by Eliminating States, Converting Regular Expressions to Automata, Applications of Regular Expressions, and Algebraic Laws for Regular Expressions. **Properties of Regular Languages:** Proving Languages not to be Regular: The pumping lemma for Regular Languages, Applications of Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages: Testing Emptiness of Regular Languages, Testing Membership in a Regular Language. Equivalence and Minimization of Automata:

UNIT - III

Context-free Languages and Pushdown Automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, Closure properties of CFLs.

UNIT - IV

Context-sensitive Languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. **Turing Machines:** The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs.

UNIT - V

Unrestricted grammars and equivalence with Turing machines, TMs as enumerators. Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Text Books:
1. John E. Hopcroft, Rajeev Motwani, Jeffery D Ullman, "Introduction to Automata Theory Languages and Computation", Third edition, Pearson Education, 2007.

Suggested Reading:
1. John C Martin. "Introduction to Language and Theory of Computation", 3rdedition, TMH, 2003.
2. Daniel Cohen, "Introduction to Computer Theory", 2ndedition, Wiley Publications, 2007.

3. Mishra K., Chandrasekaran N., "Theory of Computer Science (Automata, Languages and Computation)", 3rd edition, Prentice Hall of India 2008.
4. Shyamalendra Kandar, "Introduction to Automata Theory, Formal Languages and Computation", Pearson, 2013.
5. Kamala Krithivasan, Rama R. "Introduction to Automata Theory, and Computation", Pearson 2009.

Web Resources:

1. http://courses.cs.vt.edu/cs4114/spring2012/index.php
2. www.pearsoned.co.in/KamalaKrithivasan

18CSC18

OPERATING SYSTEMS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Programming for Problem Solving, Object Oriented Programming, Discrete Mathematics and Data Structure, Basic object-oriented design principles

Course Objectives: The objectives of this course are

1. Make the students to understand the basic components of a computer operating system, and interactionsamong the components
2. Cover an introduction on policies for scheduling, deadlocks, memory management, synchronization,system calls, and file systems.
3. Design operating system solutions

Course Outcomes: On Successful completion of the course, students will be able to

1. Define the fundamental components of a computer operating system and the interactions among them
2. Illustrate CPU scheduling algorithms, memory management techniques and deadlock handling methods
3. Build applications using semaphores and monitors to synchronize their operations
4. Analyse the performance of CPU scheduling and page replacement algorithms
5. Evaluate the structure of GNU/Linux and Android

UNIT - I

Introduction: Components of a computer operating systems, types of operating systems, operating system services, basic structure of Windows, Linux.

Processes & threads: Process states and transitions, Process Control Block (PCB), context switching, dispatcher. Threads, thread states, benefits of threads, types of threads

UNIT - II

Process Scheduling: Types of schedulers, Scheduling Criteria, scheduling algorithms, multiprocessor and real Time scheduling CPU scheduling in MS Windows

Memory Management: Memory management techniques, fragmentation, paging, segmentation, paged segmentation

UNIT - III

Inter-process Communication: Critical Section, race conditions, mutual exclusion, shared memory, message passing, semaphores and monitors, classical IPC Problems: producer-consumer, readers-writer and dinning philosopher

Deadlocks: conditions, deadlock handling methods, RAG, Banker's algorithm, deadlock recovery.

UNIT - IV

Virtual Memory: Introduction, locality of reference, page fault, thrashing, working Set, demand paging, pagereplacement algorithms, allocation of frames.

File Management: File access methods, directory structure, file system structure, Allocation methods, directory implementation, efficiency, and performance.

Disk Management: Disk structure, scheduling, reliability, disk formatting, swap space management

UNIT - V

I/O: devices, controllers, types of I/O, device drivers, Kernel I/O Structure, performance, Streams

Linux System-Design principles, modules, Process management, scheduling, memory management, I/Omanagement, file System, inter-process communication.

Mobile OS: iOS and Android architecture and SDK framework, media layer, services layer, core OS layer, filesystem.

Textbooks:

1. AviSilberschatz, Peter Galvin, Greg Gagne, " Operating System Concepts Essentials", Wiley Asia Student Edition, 9th Edition, 2015
2. William Stallings, "Operating Systems: Internals and Design Principles", Prentice Hall of India, 5th Edition, 2013.
3. Neil Smyth, iPhone iOS 4 Development Essentials Xcode, Fourth Edition, Payload media, 2011

Suggested Reading:

1. Charles Crowley, "Operating System: A Design-oriented Approach", Irwin Publishing, 1st Edition, 1996.

Online Resources:

1. https://nptel.ac.in/courses/106108101/

18CSC19

DESIGN AND ANALYSIS OF ALGORITHMS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basics of Data structures and algorithms.

Course Objectives: The objectives of this course are
1. Provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms.
2. Introduce the different algorithmic approaches for problem solving through numerous example problems.
3. Provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness.

Course Outcomes: On Successful completion of this course, student will be able to
1. List the performance metrics and design strategies of algorithms.
2. Describe the algorithmic design techniques of divide and conquer, greedy, dynamic programming,backtracking and branch and bound to solve problems.
3. Apply suitable algorithmic design techniques to solve problems.
4. Analyze the performance of a given algorithm.
5. Evaluate various algorithmic design techniques.
6. Formulate solutions to NP problem.

UNIT - I

Introduction: Characteristics of algorithm. **Analysis of algorithm:** Asymptotic analysis of complexity bounds – best, average and worst-case behavior. Performance measurements of Algorithm, Time and space trade-offs. **Analysis of recursive algorithms through recurrence relations:** Substitution method, Recursion tree method and Masters' theorem.

UNIT - II

Greedy Algorithms: The general method, Knapsack Problem, Huffman Codes, Job scheduling with deadlines. **Dynamic Programming**: The general method, 0/1 Knapsack, Travelling Salesman Problem, Matrix chain multiplication, Longest Common subsequence, Optimal Binary search tree.

UNIT - III

Backtracking: The general Method, 8-Queens Problem, Graph Coloring, Hamiltonian Cycle. **Branch-and-Bound**: The general method, FIFO branch and bound, LC branch and bound, 0/1 Knapsack Problem, Travelling Salesperson problem.

UNIT - IV

Graph Algorithms: Applications of DFS: Bi-Connected components, strongly connected components, topological sorting. **Shortest Path Algorithms**: Dijkstra's, Bellman-Ford, Floyd-Warshall and Johnson's algorithms. **Minimum Spanning Tree Algorithms**: Prim's and Kruskal's.

UNIT - V

Theory of NP-Completeness: Polynomial time, Polynomial time verification, P, NP, NP-hard and NP-Complete classes, NP-Completeness and Reducibility. **Standard NP-Complete Problems and Reduction Techniques:** The Clique Problem, vertex-cover and Subset Sum Problem.

Text Books:
1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press/McGraw-Hill, 3rd Edition, 2009.
2. E. Horowitz, sartaj sahni and sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press, 2007.

Suggested Reading:
1. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis", and Internet Examples, Wiley Second Edition.

Online Resources:
1. https://nptel.ac.in/courses/106101060/

18CSE01

WEB AND INTERNET TECHNOLOGIES
(PROFESSIONAL ELECTIVE-I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Programming and Problem Solving, Object Oriented Programming, DBMS.

Course Objectives: The objectives of this course are
1. Acquire knowledge of XHTML, Java Script and XML to develop web applications.
2. Develop dynamic web content using Java Servlets and JSP and JDBC.
3. Develop to complete web applications.

Course Outcomes: On Successful completion of the course, students will be able to
1. Develop static web sites using XHTML and Java Scripts.
2. Understand the role of XML and Java Script in web applications.
3. Write programs in java using all of its object oriented concepts.
4. Differentiate between Servlets and JSPs and use them according to the demands of the situation in developing dynamic web content.
5. Use JDBC to access a remote database in a web application.

UNIT - I

Web Basics and Overview: Introduction to Internet, World Wide Web, URL, MIME, HTTP. Introduction and basics of XHTML, Cascading Style Sheets, Introduction to XML, XML document structure, DTD, Namespacesand Schemas.

UNIT - II

The Basics of Java script: General Syntactic Characteristics, Primitive operations and Expressions, Arrays, Functions, Pattern Matching Using Regular Expressions, Document Object Model, Element Access in JavaScript, Events and Event Handling, Handling Events from Body, Button, Text Box and Password Elements. **Dynamic Documents with Java Script:** Positioning Elements, Moving Elements, Changing Colors and Fonts, Dynamic Content.

UNIT - III

The Java Language: Basics an overview of Java, The General Form of a class, Declaring Objects, Constructors, Overloading Methods, Overloading Constructors, static and final keywords, Inheritance Basics, Using Super, Using Abstract classes, Packages and Interfaces, dynamic method dispatch and Exception Handling.

UNIT - IV

J2EE Platform: Enterprise Architecture Styles, Containers and Technologies. **Servlet Programming**: Overview of Java Servlet API, Servlet Implementation, Servlet Configuration, Servlet Exceptions, Servlet Life cycle, Request and Responses. **Servlet Sessions, Context and Collaboration**: Approaches to Session tracking, Session Tracking with java servlet API, Servlet Context, Servlet Collaboration. **Filters for web applications**: Introduction to filters, filter API, Deployment descriptor for filters.

UNIT - V

JSP Basics: Introduction to JSP, Directives, Scripting Elements, Standard Objects, Design Strategies. **JSP Tag extensions**: Tag extensions, A simple Tag Anatomy of a Tag extension, Writing Tag Extensions. **Java Database Connection**: Introduction to JDBC, Database Drivers. Database Access with JDBC using servlet and jsp**:** Connection to a remote data base, CRUD operations, Callable Statement and Prepared Statement. ResultSet and RowSet objects.

Textbooks:

1. Robert W Sebesta, "Programming the World Wide Web", Pearson Education, 2013
2. CeditBuest, Subramanyam Allamraju, "Professional Java Server programming: J2EE 1.3 Edition", Apress Publications, 2007.

Suggested Reading:

1. Santosh Kumar K., "JDBC 4.2. Servlet 3.1 and JSP 2.3 Includes JSF 2.2 and Design Patterns", 2nd edition, 2016
2. 2. P. J. Deitel Deitel, H. M. Deitel – Deitel, "Internet & World Wide Web How To Program", Fourth Edition, Prentice Hall, 2007.
3. Chris Bates, "Web Programming, building intenet applications", 2nd edition, John Wiley & Sons, 2002

Online Resources:

1. https://www.w3.org/standards/webdesign/
2. https://www.w3schools.com/
3. https://devdocs.io/

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18CSE02

GUI PROGRAMMING (PROFESSIONAL ELECTIVE-I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Basics of Python Programming.

Course Objectives: The objectives of this course are
1. Understand the essence of GUI programming.
2. Identify various GUI frameworks.
3. Develop GUI based applications using GUI tools/frameworks.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand GUI frameworks / tool required for GUI programming.
2. Explore the features of PyQt for the develop GUI applications.
3. Customize GUIs by using layout managers and look-and-feel features.
4. Develop beautiful charts using the free Matplotlib Python module.
5. Design and develop UIs using threading in a networked environment to make the GUIs responsive andcompatible with Android, iOS.

UNIT - I
Introduction to GUI Programming: UI and interaction design, examples, components of GUI, comparison to other interfaces, 3-D user interfaces, and other GUI frameworks. **Introduction to PyQt5 Framework:** Overview, installation of PyQt framework, creation of a simple GUI, adding widgets to GUI, layout of widgets.

UNIT - II
Design of GUIs with Qt Designer: Installation of Qt Designer and tools, creation of a GUI, adding widgets, conversion of Qt Designer UI code to Python code.

UNIT - III
Enhancing Qt5 GUI functionality: Calling Dialogs from main window, decoupling Python code from generated UI code, building a complex GUI with PyQt5, Multi-threading to keep GUI responsive, Drag and Drop within the PyQt5 GUI.

UNIT - IV
Advanced Qt5 Programming: OpenGL Graphics library, networking and SQL database, Animation inside the GUI, CSS styling to enhancement for look-and- feel, PyQt's signals and slots, event handling.

UNIT - V
User Interface Design: Design of uesr interfaces, displaying Google and Qt5 Maps, creation of iPhone and Android Apps with Qt5. **Creation of 3D GUI with PyOpenGL and Pyglet**: PyOpenGL transforms for GUI, GUI in 3D, Pyglet transform for easy GUI, creation of slideshow using tkinter, best practices.

Text Books:
1. Burkhard A. Meier "Python GUI Programming Recipes using PyQt5", Packt, 2017.
2. Burkhard A. Meier, "Hands-on Python 3.x GUI Programming: Pack 2019.

Online Resources:
1. https://en.wikipedia.org/wiki/Graphical_user_interface#Technologies.

18CSE03

IMAGE PROCESSING
(PROFESSIONAL ELECTIVE-I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Analysis of algorithms and linear algebra.

Course Objectives: The objectives of this course are
1. Gain the fundamentals of digital image processing.
2. Comprehend the relation between human visual system and machine perception and processing ofdigital images.
3. Provide a detailed approach towards image processing applications like enhancement, segmentation,and compression.

Course Outcomes: On Successful completion of this course, student will be able to
1. Explain the basic principles of image processing and its significance in real world.
2. Interpret various types of images and applies image transformations.
3. Evaluate various approaches for image segmentation and image restoration.
4. Define image processing methods and recognize morphological image processing techniques.
5. Recognize image compression and comprehend image compression techniques in both domains.
6. Apply image processing algorithms for real world problems.

UNIT - I

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels. **Image Transforms:** 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

UNIT - II

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering. **Image Enhancement (Frequency Domain):** Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

UNIT - III

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.
Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, thresholding, Region Oriented Segmentation.

UNIT - IV

Morphological Image Processing: Basics, Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation. Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Geodesic Dilation, Erosion, Reconstruction by dilation and erosion.

UNIT - V

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

Text Books:
1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson 4th Edition, 2018.
2. S Jayaraman, S Esakkirajan, T Veerakumar, "Digital Image Processing", McGraw Hill Education, 2010.

Suggested Reading:
1. Scotte Umbaugh, "Digital Image Processing and Analysis: Human and Computer Vision Application with using CVIP Tools", CRC Press,2nd Ed, 2011.
2. Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, "Digital Image Processing using MATLAB", McGraw Hill Education, 2nd Edition, 2010.
3. Somka, Hlavac, Boyle, "Digital Image Processing and Computer Vision", Cengage Learning (Indian edition) 2008.
4. Adrian Andrew Low, "Introductory Computer Vision Imaging Techniques and Solutions", BS Pub, Second Edition, 2008.

Online Resources:

1. https://nptel.ac.in/courses/117105079/
2. www.nptelvideos.in/2012/12/digital-image-processing-html

Professor and Head Department

18CSE04

MOBILE APPLICATION DEVELOPMENT
(PROFESSIONAL ELECTIVE-I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Programming language skills, Problem solving skills, Applying technologies.

Course Objectives: The objectives of this course are
1. To demonstrate their understanding of the fundamentals of Android operating systems.
2. To demonstrate their skills of using Android software development tools.
3. To demonstrate their ability to develop software with reasonable complexity on mobile platform.

Course Outcomes: On Successful completion of the course, students will be able to
1. Interpret and Analyze Android platform architecture and features to learn best practices in Androidprogramming.
2. Design the User Interface for Mobile applications.
3. Apply Intents, Broadcast receivers and Internet services in Android App.
4. Develop database management system to retrieve and/or store data for Mobile application.
5. Evaluate and select appropriate Android solutions to the Mobile computing platform.
6. Build Android applications for complex problems.

UNIT - I
Introduction to Android Operating System: Android SDK Features, Developing for Android, Best practices in Android programming, Android Development Tools. Android application components – Android Manifest file, Externalizing resources, The Android Application Lifecycle, A Closer Look at Android Activities.

UNIT - II
Android User Interface: Introducing Layouts, User Interface (UI) Components – Editable and non editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers. Event Handling – Handling clicks or changes of various UI components. Introducing Fragments, Multi-screen Activities.

UNIT - III
Intents and Broadcasts: Introducing Intents: Using Intents to Launch Activities. Using Intent to dial a number or to send SMS. **Broadcast Receivers** –Creating Intent Filters and Broadcast Receivers: Using Intent Filters to Service Implicit Intents. Finding and using Intents received within an Activity. Notifications – Creating and Displaying notifications, Displaying Toasts.

UNIT - IV
Persistent Storage: Files – Reading data from files, listing contents of a directory, Creating and Saving Shared Preferences, Retrieving Shared Preferences. Database –Introducing Android Databases, Introducing SQLite, Content Values and Cursors, Working with SQLite Databases. Registering Content Providers, Using content Providers (insert, delete, retrieve and update).

UNIT - V
Advanced Topics: Alarms –Using Alarms. Using Internet Resources – Connecting to internet resource, using download manager. Location Based Services –Using Location-Based Services, Using the Emulator with Location-Based Services.

Text Books:
1. Reto Meier, "Professional Android 4 Application Development", Wiley India, (Wrox), 2012
2. James C Sheusi, "Android Application Development for Java Programmers", Cengage Learning, 2013

Suggested Reading:
1. Wei-Meng Lee, "Beginning Android 4 Application Development", Wiley India (Wrox), 2013

Professor and Head Department

18MTO 05

DECISION THEORY(OPEN ELECTIVE-I)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The objectives of this course are

1. Identifying and develop Operations Research Models from the verbal description of real system.
2. Able to learn different techniques to get optimum solution LPP.
3. Able to understand the Mathematical tools that are needed to solve optimization problem.
4. Able to analyze the results of the different real-world problems.
5. Able to formulate the problems and solve situation using dynamic programming problem technique.

Course Outcomes: On the successful completion of this course, the student shall be able to

1. Calculate the optimum values for given objective function by LPP
2. Solve the solution for maximise the profit with minimum cost by Transportation problem.
3. Determine the optimum feasible solution for sequencing the Jobs
4. Arrange the jobs for different Machines to get optimum values
5. Measure the solution of dynamical system problems

UNIT-I

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research, Linear Programming Problem-Formulation of LPP, Graphical solution of LPP, Simplex Method, Artificial variables, big-M method.

UNIT-II

Transportation problems, Formulation, solution, unbalanced transportation problems, finding basic feasible solutions- Northwest corner rule, least cost method and Vogel's approximations method, Optimality test: the steppingstone method and MODI method.

UNIT-III

Assignment model, formulation, Hungarian method for optimal solution, solving unbalanced problem, Traveling salesman problem and assignment problem

UNIT IV

Sequencing models, solution of sequencing problem-processing n jobs through 2 Machines-processing n jobs through 3 Machines-processing 2 jobs through m machines-processing n jobs through m machines.

U
NIT-V

Dynamic Programming, Characteristics of dynamic programming, Solution of LPP by dynamic programming and Network scheduling by PET/CPM.

Textbooks:

1. P. SankaraIyer, "Operations Research", Tata McGraw-Hill, 2008.
2. A.M. Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Educairons, 2005.

Suggested Reading:

1. J K Sharma, "Operations Research Theory & Applications, 3e", Macmillan India Ltd, 2007.
2. P.K.Gupta and D.S.Hira, "Operations Research", S.Chand& Co, 2007.
3. Kranti Swarup ,P.K.Gupta and Man Mohan "Operations Research", Sultan Chand & Sons, 2019.

Professor and Head Department

18MTO 02

GRAPH THEORY
(OPEN ELECTIVE-I)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The objectives of this course are

1. To discuss the basic and core concepts in Graph, Euler Graph and its path.
2. To explain the Matching and Covering in Bipartite Graph.
3. To demonstrate how Matching are used in Principles, Models underlying theory.
4. To explain One-Way Traffic, Rankings in a tournament.
5. To discuss Algorithmic approach to solve Network flow problems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Identify the concepts of the Graph Theory in related problems.
2. Determine the solutions in Matching and Covers, Maximum Matching in Bipartite Graph.
3. Calculate the solutions for Matching and Faster Bipartite Matching, Matching in general graphs andrelated Algorithms.
4. Apply the Knowledge of Job sequencing, One-Way Traffic, Rankings to solve real time problems.
5. Solve combinatorial optimization problems pertaining to Network flow.
6. Construct solutions to real world problems.

UNIT – I

Introduction to Graphs and its Applications: Basics of Paths, Cycles, and Trails, Connection, Bipartite Graphs, Eulerian Circuits, Vertex Degrees and Counting, Degree-sum formula, The Chinese –Postman- Problem and Graphic Sequences.

UNIT – II

Matchings: Matchings and Covers, Hall's Condition, Min-Max Theorem, Independent Sets, Covers and Maximum Bipartite Matching, Augmenting Path Algorithm.

UNIT – III

Matchings and its Applications: Weighted Bipartite Matching, Hungarian Algorithm, Stable Matchings and Faster Bipartite Matching, Factors & Perfect Matching in General Graphs, Matching in General Graphs: Edmonds' Blossom Algorithm.

UNIT – IV

Directed graphs and its Applications: Directed Graphs, Directed Paths, Directed Cycles, Applications - A Job Sequencing Problem, Designing an Efficient Computer Drum, Making a Road System One-way, Ranking the Participants in a Tournament.

UNIT – V

Networks and its Applications: Flows, cuts, Ford-Fulkerson labelling algorithm, the max-flow min-cut theorem, Applications-Menger's theorems, Feasible flows.

Text Books:

1. J.A. Bondy and U.S.R.Murty, "Graph Theory with Applications", Springer, 2008 (Freely downloadable from Bondy's website).
2. D.B.West, "Introduction to Graph Theory", Prentice-Hall of India/Pearson, 2009 (latest impression).
3. N. Deo, "Graph Theory with Applications to Engineering and Computer Science", PHI Publication, 3rd edition, 2009.

Suggested Reading:

1. R.Diestel, "Graph Theory", Springer (low price edition) 2000.
2. F.Harary, "Graph Theory", Narosa, print 2013.
3. C.L. Liu, "Elements of Discrete Mathematics", Tata McGraw Hill, 2nd Edition, 2000.

18MTO 03

NUMBER THEORY AND CRYPTOGRAPHY
(OPEN ELECTIVE-I)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The objectives of this course are
1. To introduce impart the knowledge of cryptography before computer age.
2. To introduce discrete logarithmic problem.
3. To introduce some primality tests.
4. To introduce RSA cryptography.
5. To get on exposure to elliptic curve cryptography.

Course Outcomes: On Successful completion of this course, student will be able to
1. Count different operations of basic number theory.
2. Distinguish between public Key and related algorithms.
3. Define algebraic theorems with respect to well-known algorithms.
4. Apply the Euler's φ function and related algorithms in RSA crypto system.
5. Appraise security issues on elliptic curve cryptography.

UNIT – I
Simple substitution ciphers, Divisibility and greatest common divisors, Modular arithmetic, Prime numbers, unique factorisation, and finite fields, Powers and primitive roots in finite fields, Cryptography before the computer age Symmetric and asymmetric ciphers.

UNIT – II
The birth of public key cryptography, The discrete logarithm problem, Diffie–Hellman key exchange, The ElGamal public key cryptosystem, An overview of the theory of groups, How hard is the discrete logarithm problem? A collision algorithm for the DLP.

UNIT – III
The Chinese remainder theorem, The Pohlig–Hellman algorithm, Rings, quotients, polynomials, and finite fields, Euler's formula and roots modulo pq, Primality testing.

UNIT – IV
The RSA public key cryptosystem ,Implementation and security issues, Pollard's p−1 factorisation algorithm, Factorisation via difference of squares, Smooth numbers and sieves.

UNIT – V
Elliptic curves, Elliptic curves over finite fields, The elliptic curve discrete logarithm problem, Elliptic curve cryptography.

Textbooks:
1. Mathematical Cryptography by JefreyHostein, Jill Pipher, Joseph H. Silverman Springer Science+ Business Media, LLC.
2. G.A. Jones & J.M. Jones, "Elementary Number Theory", Springer UTM, 2007.

Suggested Reading:
1. Keith Martin, "Everyday Cryptography: Fundamental Principles and Applications"
2. N. P. Smart, "Cryptography: An Introduction" 3rd edition, Springer,2016.

18MTO 04

QUANTUM COMPUTING
(OPEN ELECTIVE-I)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The objectives of this course are
1. To translate fluently between the major mathematical representations and its quantum operations.
2. To implement basic quantum algorithms.
3. To explain quantum decoherence in systems for computation.
4. To discuss the physical basis of uniquely quantum phenomena.

Course Outcomes: On Successful completion of this course, student will be able to
1. Identify the working of a Quantum Computing Program, its architecture and program model.
2. Compute basic mathematical operations.
3. Demonstrate quantum logic gate circuits.
4. Develop quantum algorithm.
5. Appraise quantum algorithm on major toolkits.

UNIT – I

Introduction to Quantum Computing: Motivation for Studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc), Origin of Quantum Computing, Overview of major concepts in Quantum Commuting (Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement).

UNIT – II

Math Foundation for Quantum Computing: Matrix Algebra: Basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen Vectors.

UNIT – III

Building Blocks for Quantum Program: Architecture of a Quantum Computing Platform, Details of q-bit system of information representation (Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from Quantum algorithmic perceptive e.g. Bell State.

UNIT – IV

Quantum Logic gates and Circuits: Quantum Logic gates and Circuit:Pauli, Hadamard, Phase shift, controlled gates, ising, Deutsch, Swap etc.), Programming model for a Quantum Computing program (Steps performed on classical computer, steps performed on Quantum Computer, Moving data between bits and qubits).

UNIT – V

Quantum Algorithms: Basic techniques exploited by quantum algorithms (Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum walks), Major Algorithms (Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm), OSS Toolkits for implementing Quantum program (IBM quantum experience, Microsoft Q, Rigetti PyQuil (QPU/QVM)).

Textbooks:

1. Michael A.Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley

Suggested Reading:

1. Jack D. HidaryQuantum Computing - An Applied Approach (Springer) 2019

18CSC20

OPERATING SYSTEMS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Course Objectives: The objectives of this course are

1. Familiarize the students with GNU/Linux environment
2. To design and apply the process management concepts.
3. To design and apply the storage management concepts.

Course Outcomes: On Successful completion of this course, student will be able to:

1. Able to use and develop shell scripts for process management
2. Demonstrate CPU scheduling and page replacement algorithms
3. Demonstrate GNU/Linux interprocess communication mechanisms and deadlock detection using Banker's algorithm
4. Evaluate CPU scheduling and page replacement algorithms
5. Design and create system calls

LIST OF EXPERIMENTS

1. Explore basic GNU/Linux utilities and vim/gvim editor features
2. Demonstration of process management system calls
3. Demonstration of thread related system calls
4. Demonstration of CPU scheduling algorithms
5. Performance evaluation of CPU scheduling algorithms
6. Demonstration of GNU/Linux IPC mechanisms- semaphores, shared memory, message passing
7. Evaluation of page replacement algorithms
8. Implementation of producer-consumer, readers- writers and dining philosopher's problem using semaphores
9. System call implementation

Textbooks:

1. K A Robbin and Steve Robbins "UNIX Systems Programming", PHI, 2003.
2. Deitel and Deitel, "Operating System", Pearson Education, New Delhi, Third Edition, 2007.

Online Resources:

1. https://www.kernel.org/
2. https://www.kernel.org/doc/html/v4.10/process/adding-syscalls.html

Professor and Head Department

18CSC21

DESIGN AND ANALYSIS OF ALGORITHMS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: PPS, Basics of Data structures and algorithms lab and OOP.

Course Objectives: The objectives of this course are
1. Design and construct simple programs by using the different design strategies for solving different problems.
2. To enhance programming skills while improving their practical knowledge in implementing the algorithms.
3. To strengthen the practical ability and to apply suitable algorithmic approaches for solving real time problems.

Course Outcomes: On Successful completion of this course, student will be able to
1. Identify and setup environment for the implementation of algorithms.
2. Implement divide and conquer, greedy, dynamic programming, backtracking and branch and boundtechniques.
3. Demonstrate various algorithmic design techniques.
4. Analyze the performance of various algorithms.
5. Compare various design strategies.
6. Formulate solutions to solve real world problems use acquired knowledge.

The following task should be carried out by the students in the laboratory for each experiment:-
1. Setup the environment for the experiment.
2. Select appropriate design technique to implement the problem.
3. Represent the solution using algorithm
4. Analyze the performance of the algorithm (Time and Space complexity)
5. Justify the performance of your solution is better than other strategies.

By performing the above task for each experiment the following COs are achieved,

Course Outcome	1	2	3	4	5	6
Task	1	2	3	4	5	*

*As all the questions are real world applications so CO6 is achieved

List of Experiments:

1. You are given the task of choosing the optimal path to connect 'N' devices. The devices are connected with the minimum required N-1 wires into a tree structure, and each device is connected with the other with a wire of length 'L' ie 'D1'connected to 'D2' with a wire of length 'L1'. This information will be available for all 'N' devices.
   a) Determine the minimum length of the wire which consists of N-1 wires that will connect all devices.
   b) Determine the minimum length of the wire which connects Di and Dj
   c) Determine the minimum length of the wire which connects Di to all other devices.
   d) Determine the minimum length of the wire which connects Di to all other devices where 1≤i≤N.
2. An X-ray telescope (XRT) is a telescope that is designed to observe remote objects in the X-ray spectrum. In order to get above the Earth's atmosphere, which is opaque to X-rays, X-ray telescopes must be mounted on high altitude rockets, balloons or artificial satellites. Planets, stars and galaxies and the observations are to be made with telescope. Here the process of rotating equipment into position to observe the objects is called slewing. Slewing is a complicated and time consuming procedure handled by computer driven motors. The problem is to find the tour of the telescope that moves from one object to other by observing each object exactly once with a minimum total slewing time.
3. CSE department of CBIT want to generate a time table for 'N' subjects. The following information is given- subject name, subject code and list of subjects code which clashes with this subject. The problem is to identify the list of subjects which can be scheduled on the same time line such that clashes among them do not exist.
4. A Test has 'N' questions with a heterogeneous distribution of points. The test-taker has a choice as to which questions can be answered. Each question Qi has points Pi and time Tito answer the question, where 1≤i≤N. The students are asked to answer the possible subsets of problems whose total point values add up to a maximum score within the time limit 'T'. Determine which subset of questions gives student the highest possible score.
5. Given N items with their corresponding weights and values, and a package of capacity C, choose eitherthe entire item or fractional part of the item among these N unique items to fill the package such that the package has maximum value.
6. Given a bunch of projects, where every project has a deadline and associated profit if the project is finished

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before the deadline. It is also given that every project takes one month duration, so the minimum possible deadline for any project is 1 month. In what way the total profits can be maximized if only one project can be scheduled at a time.

7. N-Queen is the problem of placing ‘N’ chess queens on an N×N chessboard. Design a solution for this problem so that no two queens attack each other.
   Note: A queen can attack when an opponent is on the same row, column or diagonal.
8. Bi-connected graphs are used in the design of power grid networks. Consider the nodes as cities and the edges as electrical connections between them, you would like the network to be robust and a failure at one city should not result in a loss of power in other cities.
9. Consider a source code structure where you are building several libraries DLLs (Dynamic- Link Library) and they have dependencies on each other. For example, to build DLL , you must have built DLLs B, C and D (Maybe you have a reference of B,C and D in the project that builds A).

Textbooks:

1. Thomas H Cormen, Charles E Lieserso, Ronald L Rivesr and Clifford Stein, “Introduction to algorithms”, 3rd Edition, MIT Press/McGraw-Hill, 2009
2. Michel T Goodrich and Roberto Tamassia, “Algorithm Design: Foundations, Analysis and Internet Examples”. Second Edition, Wiley, 2001.

18CSE05

WEB AND INTERNET TECHNOLOGIES LAB
(PROFESSIONAL ELECTIVE-I LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Programming and Problem Solving, Object Oriented Programming, DBMS.

Course Objectives: The objectives of this course are
1. To acquire knowledge of XHTML, Java Script and XML to develop web applications.
2. Ability to develop dynamic web content using Java Servlets, JSP and JDBC.
3. To understand the design and development process of a complete web application.

Course Outcomes: On Successful completion of this course, student will be able to
1. Students will be able to develop static web sites using XHTML and CSS
2. Validate form data and create dynamic content using javascript
3. Develop Dynamic web content using Java Servlets and JSP
4. Handle Sessions and use servlet filters in web applications.
5. Validate form data and create dynamic content using javascript

LIST OF PROGRAMS
1. Design simple web pages using XHTML and CSS.
2. Categorize the content of web page using XML and validate using DTD and XML schema.
3. Create well structured, easily maintained web pages using CSS and Java script.
4. Examine dynamic web pages using Java script.
5. Design a dynamic webpage that meets specified requirements and interests of end users.
6. Apply the concepts of Inheritance and interfaces to solve complex problems.
7. Analyse and apply the concepts of Exception handling and packages.
8. Handling HTTP Sessions in web applications.
9. Demonstrate Servlet Collaboration using Servlet Context.
10. Creation of dynamic content in web application using JSP.
11. Provide a program level interface for communicating with database using JDBC.

Text Books:
1. Robert W Sebesta, “Programming the World Wide Web”, Pearson Education, 2013
2. Cedit Buest, Subramanyam Allamraju, “Professional Java Server programming: J2EE 1.3 Edition”, Apress Publications, 2007.

Suggested Reading:
1. Santosh Kumar K, “JDBC 4.2, Servlet 3.1 and JSP 2.3 Includes JSF 2.2 and Design Patterns”, 2nd edition, 2016.

Online Resources:
1. https://www.w3schools.com/
2. https://www.tutorialspoint.com/servlets/index.htm.
3. https://www.oracle.com/technical-resources/articles/javase/servlets-jsp.html

Professor and Head Department

18CSE06

GUI PROGRAMMING LAB
(PROFESSIONAL ELECTIVE-I LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Basics of Python Programming.

Course Objectives: The main objectives of this course are

1. To familiarize the students with GUI development tools/frame works.
2. To Explore the features of PyQt and GUI Module.
3. To prepare the students developing GUI Applications.

Course Outcomes: On Successful completion of this course, student will be able to

1. Install and explore the features of selected IDE and frameworks.
2. Create widgets, buttons, tools and customize them using layout management tools.
3. Design user interfaces for the selected problem.
4. Implement the designed UI using PyQt and Dt Designer.
5. Customize UIs by using threading and make them responsive that are compatible with Android and iOS.

LIST OF PROGRAMS

1. Identification and installation of required software and tools.
2. Exploration of the installed IDEfor the development of GUI based applications
3. Demonstration of various buttons and tools.
4. Layout management of Widgets, buttons usngPyQt layout management tools.
5. Applying multithreading to make the GUI responsive.
6. Installation and exploration of Qt Designer.
7. Understanding and I/O requirements gathering for the selected problem.
8. Design of UI for the selected problem.
9. Implementation of the selected problem.
10. Enhancement of UI with CSS, event handling.
11. Applying 3D transformations using PyOpenGL.
12. Creation of slideshow using Tkinter.

Sample problems: Student marks management, Leave management, Attendance management, bank management, Student gate pass system, library management system, salary management system, canteen billing system, Bus ticket reservation system, Flight reservation system etc

Text Books:

1. Burkhard A. Meier "Python GUI Programming Recipes using PyQt5", Packt, 2017
2. Burkhard A. Meier, "Hands-on Python 3.x GUI Programming: Pack 2019

Online Resources:

1. https://www.tutorialspoint.com/python/python_gui_programming.htm
2. https://www.geeksforgeeks.org/python-gui-tkinter/

18CSE07

IMAGE PROCESSING LAB
(PROFESSIONAL ELECTIVE-I LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Basics of programming language.

Course Objectives: The objectives of this course are
1. To impart knowledge about the fundaments concepts of digital image processing.
2. To study various image transformation and enhancement techniques used in digital image processing.
3. To discuss about the image reformation, segmentation techniques used in digital image processing.

Course Outcomes: On Successful completion of this course, student will be able to
1. Identify the fundamental issues and challenges of image processing.
2. Translate images from spatial to frequency domain by applying various transformations.
3. Perform point operations and filtering in both domains.
4. Apply various techniques to enhance and analyze the image in detail.
5. Interpret various compression techniques and edge detection methods.
6. Evaluate Image processing algorithms for real-world problems.

LIST OF THE EXPERIMENTS:
1. Implement Point processing on images in spatial domain.
   a. Negation of an image.
   b. Thresholding of an image.
   c. Contrast Stretching of an image.
2. Implement Bit Plane Slicing on images.
3. Implement Histogram Equalization on images.
4. Implement Histogram Specification on images.
5. Implement Zooming by interpolation and replication on images.
6. Implement Filtering in spatial domain
   a. Low Pass Filtering
   b. High Pass Filtering
   c. Median filtering.
7. Implement Edge Detection using derivative filter mask
   a. Prewitt
   b. Sobel
   c. Laplacian
8. Implement Data compression using Huffman coding
9. Implement filtering in frequency domain
   a. Low pass filter
   b. High pass filter
10. Implement Hadamard transformation.

Text Books:
1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, 4th Edition, Pearson, 2018
2. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image Processing”, - Mc Graw Hill Education, 2010.

Suggested Readings:
1. Scotte Umbaugh, “Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools”, 2nd Ed, CRC Press, 2011
2. Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, “Digital Image Processing using MATLAB”, 2nd Edition, Mc Graw Hill Education, 2010.

18CSE08

MOBILE APPLICATION DEVELOPMENT LAB
(PROFESSIONAL ELECTIVE-I LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Programming language skills, Problem solving skills.

Course Objectives: The objectives of this course are
1. To learn how to develop Applications in android environment.
2. To learn how to develop user interface applications.
3. To learn how to develop URL related applications.

Course Outcomes: On Successful completion of this course, student will be able to
1. Analyze all the components and their properties of various Emulators to select appropriate Emulator for Android App.
2. Apply essential Android programming concepts for developing efficient Mobile App.
3. Develop Android applications related to various Layouts.
4. Design applications with rich User interactive Interfaces.
5. Develop Android applications related to Mobile related server -less database like SQLite.
6. Extend Event Handling to develop various Mobile applications.

The student is expected to be able to do the following problems, though not limited.
1. Create an Android application that shows Hello + name of the user and run it on an emulator. (b) Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.
2. Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button. Use (a) Linear Layout, (b) Relative Layout and (c) Grid Layout or Table Layout.
3. Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a “Back” button. If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on right fragment instead of second screen with back button. Use Fragment transactions and Rotation event listener.
4. Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.
5. Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.
6. Create an application that uses a text file to store user names and passwords (tab separated fields and one record per line). When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with Login Failed message.
7. Create a user registration application that stores the user details in a database table.
8. Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially. Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user.

Tools:
1. Geny Motion Emulator.
2. Android Application Development with MIT App Inventor: For the first one week, the student is advised to go through the App Inventor from MIT which gives insight into the various properties of each component. The student should pay attention to the properties of each component, which are used later in Android programming.

Following are useful links:
1. http://ai2.appinventor.mit.edu
2. https://drive.google.com/file/d/0B8rTtW_91YclTWF4czdBMEpZcWs/view

Professor and Head Department

18CSC22

MINI PROJECT

Instruction	3Hours per week
CIE	50 Marks
Credits	1

Objective: The main objective of this mini project is to explore and strengthen the understanding of fundamentals through practical application of theoretical concepts. It enables the students to design and develop solutions to real world problems by applying programming knowledge to become a good engineer. It acts like a beginners guide to do larger projects later in their career.

Course Outcomes: At the end of the course, students will be able to

1. Identify and understand the real world problems.
2. Formulate the solutions to the problems by applying Computer Science and Mathematical fundamentals.
3. Represent the solutions by using various design aids/charts/diagrams.
4. Implement the solutions using modern tools/languages.
5. Analyze and interpret the experimentation results, draw conclusions
6. Communicate effectively through technical reports and presentation according to the documentation/report guidelines

Some of the guidelines for Mini Project:

1. **Selection of Topic**: Selection of topic is a huge and important task in a Mini Project. One should have a clear idea about one's subject strengths and the selected topic should be relevant to it. Always select the project that has value addition. As a graduate you should select a project which is either advantageous to a lot of people or enhance your technical and managerial skills. Your project must play its role towards a positive growth/development in that specific field.
2. **Research about the selected topic online:** Do some online research about the selected topic. Go through the research papers from different researchers around the world on the topics related to Mini Project. Find some websites containing the information about the materials used for Mini Project.
3. **Suggestions from subject experts:** Go to the subject experts in your department and interact with them about the Mini Project topic. You can also meet many subject experts from other department or various parts of the society through physically or social media and some discussion forums. This helps you in getting suggestions in different possible ways, through which you can get a clear idea on your Mini Project topic.
4. **Planning:** After getting a clear idea about the topic, prepare a rough plan about procurement of resources, experimentation and fabrication along with your teammates. Make a rough schedule, adapt to it and distribute the work among your teammates. This will keep your Mini Project on track and individuals will come to know about their part in the Mini Project rather than any individual (leader) taking full responsibilities.
5. **Execution of plans:** Make sure that the materials will be ready for the experimentation/fabrication by the scheduled time. Follow the schedule during experimentation/fabrication to get accurate and efficient results.
6. **Presentation:** Experimentation/Fabrication does not make a Mini Project successful; one should be able to present the results in proper way. So it should be prepared in such a way that, it reflects the exact objective of your Mini Project.

Guide lines / Instructions:

1. Each Mini project must be done in a group of 2-3 students.
2. Choose the topic/problem related to the fields/courses studied earlier or current semester
3. Each group must prepare a title of the mini project that relates to any engineering discipline and the title must emulate any real-world situation / problem.
4. Submit an early proposal (1-2 pages report describing what is the project about and the outcome of the final product would be, by the end of **Fourth Week**.
5. The title must be submitted to the respective lecturer by the end of week 9
6. Report must be submitted during the project presentation (**14th Week**)
7. Students are required to carry out the mini project in any one of the areas/courses that they have studied earlier or studying currently.
8. The progress of the mini project is monitored by the mentor and coordinator **every week**. Each student has to maintain a **project diary** duly signed by the mentor

Assessment:

1. 10% Early proposal (abstract)
2. 50% Continuous evaluation (progress of the project including literature review, design, development, coding, documentation according to the time lines)
3. 20% presentation and demonstration (structured, fluent, logic, output) ; 10% Viva Voce (Evaluated by internal PRC-Project Review Committee)
4. 10% Final Report writing

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Report: A report must contain the complete project details. The layout or the organization of the report as follows:

- Summary / Abstract
- Introduction
- Software specifications
- Design of the problem (Block diagram / structured chart; Flow Chart functions or Pseudocode for the subprogram
- Results and Discussions
- Conclusion and Future work
- References, Appendix and coding. System manual-How to use the system

Note: Please find the specimen copy of the project report in the institute website.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
SCHEME OF INSTRUCTION AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING

SEMESTER –VI

S. No	Course Code	Title of the Course	Scheme of Instruction			Duration of SEE in Hours	Scheme of Examination		
			Hours per Week				Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
THEORY									
1	18CSC23	Data Communication and Computer Networks	3	0	0	3	30	70	3
2	18CSC24	Software Engineering	3	0	0	3	30	70	3
3	18CSC25	Artificial Intelligence	3	0	0	3	30	70	3
4	18CSE XX	Professional Elective-II	3	0	0	3	30	70	3
5	18CSE XX	Professional Elective-III	3	0	0	3	30	70	3
6	18MBC 01	Engineering Economics and Accountancy	3	0	0	3	30	70	3
7	18EEM 01	Indian Traditional Knowledge	2	0	0	2	-	50	0
PRACTICAL									
8	18CSC26	Data Communication and Computer Networks Lab	0	0	3	3	25	50	1.5
9	18CSC27	Case Study	0	0	2	2	50	-	1
		TOTAL	**20**	**00**	**05**		**255**	**520**	**20.5**

PROFESSIONAL ELECTIVE-II	
Course Code	**Title of the Course**
18CSE09	Internet of Things
18CSE10	Parallel and Distributed Algorithms
18CSE11	Cloud Computing
18CSE12	Computer Vision

PROFESSIONAL ELECTIVE-III	
Course Code	**Title of the Course**
18CSE13	Soft Computing
18CSE14	Network and System Administration
18CSE15	Mobile Computing
18CSE16	Free and Open-Source Software

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

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18CSC23

DATA COMMUNICATION AND COMPUTER NETWORKS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basic programming and problem solving.

Course Objectives: The objectives of this course are

1. To understand the principles of data communication and organization of computer networks
2. To analyze various routing and congestion control algorithms.
3. To study the functionality of the transport layer and understanding different application layer protocols.

Course Outcomes: On Successful completion of this course, student will be able to

1. Define the communication protocol suites like ISO-OSI and TCP/IP.
2. Illustrate and explain Data Communications System and its components.
3. Identify and analyze various routing algorithms, congestion control algorithms.
4. Distinguish the internet protocols like IP, ARP, ICMP, IGMP, BGP, OSPF, and DHCP.
5. Outline the transport layer protocols like TCP, UDP, RTCP.
6. List and examine the applications of HTTP, WWW, DNS, Email, FTP and the underlying protocols.

UNIT - I

Introduction: Data communication, network types and models, TCP/IP and OSI Protocol Suite, transmission media (wired and wireless), switching.

UNIT - II

Data Link Layer: Design issues, error detection and correction, elementary data link protocols, sliding window protocols, multiple access protocols.

LAN: Wired LAN, wireless LAN, connecting devices and wireless LAN.

UNIT - III

Network Layer: Network layer design issues, routing algorithms, congestion control algorithms, Quality of service, IPV4, IPV6, Internet, network layer protocols -ARP, RARP, BOOTP and DHCP.

UNIT - IV

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP, congestion control, quality of service.

UNIT - V

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls.

Textbooks:

1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw– Hill, Fifth Edition, 2013.
2. S. Tanenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2013
3. William Stallings, “Data and Computer Communication”, Eighth Edition, Pearson Education, 2007.

Suggested Reading:

1. Larry L.Peterson, Peter S. Davie, “Computer Networks”, Elsevier, Fifth Edition, 2012. 2. James F. Kurose, Keith W. Ross, “Computer Networking: A Top–Down Approach Featuring the Internet”, Pearson Education, 2005.

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105081/
2. https://nptel.ac.in/courses/106/106/106106091/

18CSC24

SOFTWARE ENGINEERING

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are
1. To understand the Software Engineering Practice & Process Models.
2. To understand Design Engineering, and Software Project Management.
3. To gain knowledge of the overall project activities.

Course Outcomes: On Successful completion of this course, student will be able to
1. State the software process and the perspective process model, evolutionary and agile process models.
2. Interpret the Requirements of Software Product and Estimate the cost of software using empiricalmodels.
3. Demonstrate the skills necessary to specify the requirements of software product.
4. Recall the design principles and construct a product using coding principles and standards.
5. Prepare test cases and Apply software testing methods like White Box, Black box, and O-O.
6. Identify the configuration Management and estimates software quality and metrics of maintenance.

UNIT - I

Introduction to Software Engineering: The nature of Software, Software Engineering, The Software Process**,** Software Engineering Practice. **Process Models:** A Generic Process Model, Process Framework, CMMI, Prescriptive Process Models: Waterfall Model, Incremental Process Models, Evolutionary Process Models -Prototyping, The Spiral Model, Concurrent Models. **An Agile View of Process**: Agility, Agile Process, and Agile Process Models- Extreme Programming (XP), Adaptive Software Development (ASD).

UNIT - II

Requirement Engineering: Understanding Requirements: Establishing the Groundwork, Requirement Engineering tasks, Initiating the Requirements Engineering Process, Eliciting Requirements. **Software Requirements Analysis and Specification**: Problem Analysis, Requirements Specification, Decision Tables, SRS Document, IEEE Standards for SRS, Case Studies. **Planning and Managing the Project**: Managing Software Project, Project Personnel, Effort Estimation, Risk Management, the Project Plan and Software project estimation – Empirical estimation models.

UNIT - III

Design Engineering: Design Principles, Design Notation and Specification, Design Concepts, Flow oriented modeling. The function-oriented design for the case studies, O-O Design Concepts, Modeling Component-Level Design. **Architectural Design:** Software Architecture, Data Design, A Brief Taxonomy of Architectural Styles. **Implementation:** Coding Principles and Standards, Coding Process, Code Verification.

UNIT - IV

Testing Strategies: A Strategic approach to software testing, strategic issues, test strategies for Conventional and O-O Software, Validation Testing, System Testing, Art of Debugging. **Testing Tactics**: Software Testing Fundamentals, White Box Testing: Basis Path Testing, Control Structure Testing, O-O Testing methods. Black Box Testing

UNIT - V

Software Quality Assurance – Managing Software Project, Quality concepts Software Quality Assurance Software Reviews, Technical Reviews, Software Reliability. **Software Configuration Management**: Identification of Objects in the Software Configuration, Configuration Audit, SCM standards. **Software Maintenance**: Categories of Maintenance, Software reuse, Metrics for maintenance.

Text Books:
1. Roger S. Pressman, “Software Engineering: A practitioner’s approach”, 7th edition, McGraw Hill, 2010.
2. Shari Lawrence Pfleeger, “Software Engineering Theory and Practices”, 4th Edition, Pearson Education, India, 2011.
3. Pankaj Jalote”An integrated approach to Software Engineering”, Springer/ Narosa, 2014

Suggested Reading:
1. Sommerveli “Software Engineering”, 10TH Edition, Pearson,2015
2. Rajib Mal “Fundamental of Software Engineering”, 4th Edition, PHI Learning, 2014.

Online Resources:
1. https://nptel.ac.in/courses/106101061/

Professor and Head Department

18CSC25

ARTIFICIAL INTELLIGENCE

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Data structures, Discrete Mathematics, Probability Theory.

Course Objectives: The objectives of this course are

1. To list the significance of AI.
2. To discuss the various components that is involved in solving an AI problem.
3. To analyze the various knowledge representation schemes, reasoning and learning techniques of AI.

Course Outcomes: On Successful completion of this course, student will be able to

1. Explain the role of agents and interaction with the environment to establish goals.
2. Identify and formulate search strategies to solve problems by applying suitable search strategy.
3. Compare and contrast the various knowledge representation schemes of AI.
4. Appraise probabilistic reasoning and Markov decision process to solve real world problems.
5. Apply the AI concepts to build an expert system to solve the real-world problems.
6. Describe learning paradigms in machine learning.

UNIT - I

Introduction: Concept of Al, history, current status, scope, Problem Formulations, Review of tree and graph structures. **Intelligent agents:** Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - II

Problem Solving - State - Space Search and Control Strategies: State space representation, Search graph and Search tree. Random search, Search with closed and open list, Depth first and Breadth first search. Heuristic search, Best first search. A* algorithm, problem reduction, constraint satisfaction, Game Search, minmax algorithm, alpha beta pruning.

UNIT - III

Logic Concepts and Logic Programming: Introduction, Propositional Calculus Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Table, A System in Propositional Logic, Resolution, Refutation in Propositional Logic, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT - IV

Probabilistic Reasoning: Probability, inference using full joint distributions, Bayes rule, Bayesian networks-representation, construction, exact and approximate inference, temporal model, hidden Markov model. **Markov Decision process:** MDP formulation, utility theory, multi attribute utility functions, decision networks, value iteration, policy iteration and partially observable MDPs.

UNIT - V

Expert System and Applications: Introduction, Phases in Building Expert Systems Expert System Architecture, Expert Systems Vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and tools. **Machine - Learning Paradigms:** Introduction, Machine learning System, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees, Deductive Learning, Clustering.

Text Books:

1. Russell, Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 3nd Edition, 2010.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, First Edition, 2011.

Suggested Reading:

1. Rich, Knight, Nair, "Artificial Intelligence", Tata McGraw Hill, 3rd Edition 2009.
2. Trivedi. M.C., "A classical approach to Artificial Intelligence", Khanna Publishing House, Delhi.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

Professor and Head Department

18MBC01

ENGINEERING ECONOMICS AND ACCOUNTANCY

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are:
1. To demonstrate the importance of Managerial Economics in decision making.
2. To understand the importance of project evaluation in achieving a firm's objective.
3. To explain the concept of Accountancy and provide basic knowledge on preparation and analyzing of Final accounts.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Apply fundamental knowledge of Managerial economics concepts and tools.
2. Understand various aspects of demand analysis and forecasting
3. Analyze production and cost relationships to make best use of resources available.
4. Analyze different opportunities and come out with best feasible capital investment decisions
5. Apply accountancy concepts and conventions and preparation of final accounts.

UNIT - I

Introduction to Managerial Economics : Introduction to Economics and itsevolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

UNIT II –

Demand and Supply Analysis : Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

UNIT III –

Production and Cost Analysis: Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns; Internal and External Economies of Scale.
Cost Analysis: Cost concepts Types of Costs, Cost-Output Relationship Short Run and Long Run; Market structures Types of Competition, Features, Price Output Determination under Perfect Competition, Monopoly and Monopolistic Competition; Break-even Analysis Concepts, Assumptions, Limitations, Numerical problems.

UNIT IV –

Accountancy: Book-keeping, Principles and Significance of Double Entry Book Keeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments. Ratio Analysis.

UNIT V –

Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical problems.

Text Books:
1. MehtaP.L.,"Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's
2. Educational publishers, 2016.
3. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 11th Edition, 2013. PandayI.M. "Financial Management", 11th edition, Vikas Publishing House, 2015.

Suggested Readings:
1. Varshney and KL Maheswari, "Managerial Economics", Sultan Chand, 2014.
2. M.Kasi Reddy and S.Saraswathi, "Managerial Economics and Financial Accounting", Prentice Hall of India Pvt Ltd, 2007.
3. A.R.Aryasri, "Managerial Economics and Financial Analysis", McGraw-Hill, 2013.

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18EEM 01

INDIAN TRADITIONAL KNOWLEDGE

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Credits	0

Course Objectives: The objectives of this course are :

1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand the culture, civilization, and heritage of Ancient, Medieval and Modern India.
2. Distinguish various Languages and Literature existing in India
3. Discuss and Compare Philosophy and Religion in Indian since ancient times
4. Explore various Fine arts in Indian History, and Illustrate the development of Science and Technologyin India.
5. Describe the Indian Education System, and recognize the efforts of scientist to the development ofIndia

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II

Indian Languages, Culture and Literature:

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV

Fine arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT-V

Education system in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”, ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. S. Narain, “Examinations in ancient India”, Arya Book Depot, 1993
4. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
5. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Reading:

1. Kapil Kapoor, “Language, Linguistics and Literature: The Indian Perspective”, ISBN-10: 8171880649, 1994.
2. Karan Singh, “A Treasury of Indian Wisdom: An Anthology of Spiritual Learn”, ISBN: 978-0143426158, 2016.

18CSC26

DATA COMMUNICATION AND COMPUTER NETWORKS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Basics of Operating System, Linux Commands.

Course Objectives: The objectives of this course are

1. To familiarize students with the communication media, devices, and protocols.
2. To expose students to gain practical knowledge of computer networks configuration and monitoring.
3. To create network simple computer networks using simulation tools.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify the different types of equipment like cables used in the networks Lab.
2. Recognize the various network devices like repeater, hub, switch.
3. Practice the basic network commands like ifconfig, ping, traceroute, nslookup, dig, arp, netstat, nmap.
4. Design and demonstrate network topologies using NS3 simulation tool.
5. Examine the packet transfer using NetAnim.
6. Analyze the network performance using Wire shark or any tool.

LIST OF EXPERIMENTS:

1. Study of Network media, cables, and devices and Cable Construction
2. Demonstration of basic network commands/utilities (both in Windows and Linux)
3. PC Network Configuration
4. Building a switch-based network / Configuration of Cisco Catalyst Switch 3560
5. Configuration of Cisco Router 2900
6. Basic OSPF configuration
7. Basic EIGRP Configuration
8. Analysis of network traces using tcpdump
9. Analysis of network traces using Whireshark

Textbooks:

1. S. Tanenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2013.

Online Resources:

1. https://learningnetwork.cisco.com/s/question/0D53i00000Kt7EkCAJ/tools-for-ccnp-network- simulator-lab-tasks
2. https://www.packettracernetwork.com/
3. https://www.ghacks.net/2019/11/13/gns3-is-an-open-source-graphical-network-simulator-for- windows-linux-and-macos/
4. https://www.imedita.com/blog/top-10-list-of-network-simulation-tools/

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18CSC27

CASE STUDY

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Case studies are common in engineering where we analyse (study) situations. Case study exercise is a realistic simulation of a real life situation or strategic problem we are likely to encounter in our workplace or surroundings. A case study is actually "analysing, applying engineering and science knowledge, reasoning and drawing conclusions" to solve a real situation. Case studies are different types including historical, real life, problem oriented etc.

Course Objectives: The objectives of this course are
1. To expose students to real life problems/events/situations and technologies
2. To promote individual study, critical thinking and group discussions to build team work
3. To inculcate the culture of self-learning, professional ethics communication

Course Outcomes: On successful completion of the case study, students will be able to
1. Understand real life situations, problems, developments of technologies in Computer science
2. Interpret, analyse, and think critically about the events, situations and gather information from varioussources for formulating solutions
3. Apply learned knowledge and commit to decisions
4. Evaluate the approach and solution to the event/problem by considering efficiency and optimization
5. Communicate efficiently both in written and orally to discuss the recommendations

Suggestions to select case studies
- For a real situation case study, you can choose an event at your workplace to analyse.
- For a historical case study, you can take a recent collapse/development of a company /technology /project (Cambridge Analytica, Google, Facebook, AI, ML, IoT, GitHub, GNU, LibreOffice, FOSS etc.) and analyse what went wrong or gave raise.
- For a problem oriented case study, choose a problem where they need to (Situation-- Problem-Solution(s)--Evaluation):
  - understand the situation faced (significance),
  - analyse the specific problem to be tackled,
  - create, analyse, and refine a solution and
  - further evaluate, improve and implement

Instructions:
- Students need to choose a case in consultation with any one of their class teachers and mentor
- The topic should be confined to the areas/courses of AI, SE, IoT,
- Submit an abstract consisting of the significance, objectives, methodology and work plan by the end of 3rd week
- Every week they need to show progress to the concerned teacher and mentor
- Shall present/demonstrate and submit a report(read the Case Study guide lines)

Assessment: The main focus of case studies are to assess the approach and the solution arrived. In fact, case studies are usually designed not to have one 'correct' answer. As long as the students justify their recommendation, and stand up to interrogation from the assessor, they are likely to score marks. Students will be monitored by an internal teacher along with their mentors and evaluated by the external examiner at end.

18CSE09

INTERNET OF THINGS
(PROFESSIONAL ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Computer Architecture and Microprocessor, Programming Basics.

Course Objectives: The objectives of this course are

1. Impart necessary and practical knowledge of components of Internet of Things.
2. Understand IoT Protocols.
3. Develop skills required to build real-time IoT based projects.

Course Outcomes: On Successful completion of this course, student will be able to

1. Identify hardware and software components of Internet of Things.
2. Interface Input-Output devices, sensors with Arduino and Raspberry Pi using communication modules.
3. Analyze the use of communication protocols in IoT.
4. Remotely monitor data and subsequently control various devices.
5. Develop real time IoT based projects.
6. Applications of IoT in various domains such as health care, industrial automation.

UNIT - I

Introduction to IoT: Architectural Overview, Design principles and requirements of IoT, IoT Applications. **Elements of IoT:** Basics of networking, sensors, actuators, computing devices, software, data management and processing environment and Security issues.

UNIT - II

IoT Hardware Components: Computing (Arduino, Raspberry Pi), Communication, Sensors, Actuators, I/0 interfaces, Programming API's (for Arduino and Rasp berry Pi).

UNIT - III

IoT Protocols: 6LowPAN,RPL, IPV6, WiFi, ZigBee, Bluetooth, BLE, MQTT, CoAP, RFID.

UNIT - IV

IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

UNIT - V

IoT Case Studies: IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.

Text Books:

1. Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, “Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers, Series in Communications, 2013.

Online Resources / Web links / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, “Internet of Things in Industries: A Survey “, IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik , JP. Vasseur, R. Alexander, “RPL: IPv6 Routing Protocol for Low-Power and Lossy Networks”, IETF, Standards Track, Mar. 2012.

3. Z. Shelby, K. Hartke, C. Bormann, “The Constrained Application Protocol (CoAP)”**,** Internet Engineering Task Force (IETF), Standards Track, 2014.
4. L.Fenzel, “What’s The Difference Between IEEE 802.15.4 And ZigBee Wireless?”, Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, "Information theoretic self-management of Wireless Sensor Networks", Proceedings of NCC 2013.
6. F. Luo et al., "A Distributed Gateway Selection Algorithm for UAV Networks," in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22-33, March 2015.

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18CSE10

PARALLEL AND DISTRIBUTED ALGORITHMS
(PROFESSIONAL ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are
1. To acquaint students with the basic concepts of parallel and distributed computing.
2. To provide knowledge of parallel computing platforms.
3. To learn parallel and distributed algorithms development techniques for shared memory and message passing models.
4. To equip the students with modern parallel and distributed approaches for solving problems in emerging applications.

Course Outcomes: On Successful completion of this course, student will be able to
1. Describe the models and techniques for parallelization.
2. Make use of list ranking and graph coloring parallel Algorithms.
3. Analyze parallel algorithms and compute their complexity measures.
4. Develop parallel programs for search and matrix multiplication using open MP.
5. Choose a parallel algorithm that makes good use of the target Architecture.
6. Describe the distributed Algorithms to learn its models and complexity measures.

UNIT - I
The Idea of Parallelism: A Parallelized version of the Sieve of Eratosthenes. PRAM Model of Parallel Computation. Pointer Jumping and Divide & Conquer: Useful Techniques for Parallelization.

UNIT - II
PRAM Algorithms: Parallel Reduction, Prefix Sums, List Ranking, Preorder Tree Traversal, Merging Two Sorted Lists, Graph Coloring, Reducing the Number of Processors and Brent's Theorem, Dichotomy of Parallel Computing Platforms, Cost of Communication, Programmer's view of modern multi-core processors.

UNIT - III
The role of compilers and writing efficient serial programs, Parallel Complexity: The P-Complete Class, Mapping and Scheduling, Elementary Parallel Algorithms for Sorting.

UNIT - IV
Parallel Programming Languages: Shared Memory Parallel Programming using OpenMP
Writing efficient openMP programs, Dictionary Operations: Parallel Search, Graph, Algorithms and Matrix Multiplication.

UNIT - V
Distributed Algorithms: models and complexity measures. Safety, liveness, termination, logical time and event ordering, Global state and snapshot algorithms, Mutual exclusion and Clock Synchronization, Distributed Graph algorithms.

Text Books:

1. Michael J Quinn, “Parallel Computing: Theory and practice”, Tata McGraw Hill, 1993.
2. Roman Trobec, Boštjan Slivnik, Patricio Bulić, Borut Robič, “Introduction to Parallel Computing”, Springer, 2018.
3. Joseph Jaja, “Introduction to Parallel Algorithms”, First Edition, Addison Wesley, 1992.

Suggested Reading:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, “Introduction to Parallel Computing”, Second Edition, Addison Wesley, 2003

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc19_cs17/preview
2. https://nptel.ac.in/courses/106102163/

18CSE11

CLOUD COMPUTING
(PROFESSIONAL ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are:
1. To impart the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they can adopt Cloud Computing services and tools in their real life scenarios.
3. To provide knowledge about security and privacy issues related to cloud computing environments.
4. To enable students explore cloud computing driven commercial systems such as Google App Engine, Microsoft Azure and Amazon Web Services and others

Course Outcomes: On successful of the course student will be able to:
1. Define Cloud Computing and related concepts and describe the characteristics, advantages, risks and challenges associated with cloud computing.
2. Explain and characterize various cloud service models, cloud deployment models.
3. Explore virtualization techniques that serve in offering software, computation and storage Services onthe cloud.
4. Illustrate the concepts of cloud storage and demonstrate their use in storage systems such as AmazonS3 and HDFS.
5. Understand the security and privacy issues related to cloud computing environments.
6. Investigate/Interpret the security and privacy issues related to cloud computing environments.

UNIT - I
Introduction to Cloud Computing: Cloud Computing in a Nutshell, System Models for Distributed and Cloud Computing, Roots of Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, Basic Principles of Cloud Computing, Challenges and Risks, Service Models.

UNIT - II
Virtual Machines and Virtualization of Clusters and Data Centers: Levels of Virtualization, Virtualization Structures//Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization Data-Center Automation. Case studies: Xen Virtual machine monitors- Xen API. VMware - VMware products-Vmware Features. Microsoft Virtual Server - Features of Microsoft Virtual Server.

UNIT - III
Cloud computing architectures over Virtualized Data Centers: Data-Center design and Interconnection networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, GAE, AWS, Azure, Inter-cloud Resource Management.

UNIT - IV
Cloud Security and Trust Management, Data Security in the Cloud : An Introduction to the Idea of Data Security, The Current State of Data Security in the Cloud, CryptDb: Onion Encryption layers-DET,RND,OPE,JOIN,SEARCH, HOM, and Homomorphic Encryption, FPE. Trust, Reputation and Security Management.

UNIT - V
Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, parallel and distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments. Common Standards in Cloud Computing: The Open Cloud Consortium, the Distributed Management Task Force, Standards for Application Developers, Standards for Messaging. Internet Messaging Access Protocol (IMAP), Standards for Security, Examples of End-User Access to Cloud Computing.

Text Books:

1. John W. Rittinghouse, "Cloud Computing: Implementation, Management, and Security ". James F. Ransome, CRC Press 2009.
2. Kai Hwang. Geoffrey C.Fox, Jack J. Dongarra, “Distributed and Cloud Computing From Parallel Processing to the Internet of Things”, Elsevier, 2012.
3. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski,” Cloud Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing), Wiley Publishing ©2011.

Suggested Reading:

1. Raluca Ada Popa, Catherine M.S. Redfield, Nickolai Zeldovich, and Hari Balakrishnan, “CryptDB: Protecting Confidentiality with encrypted Query Processing”, 23rd ACM Symposium on Operating Systems Principles (SOSP 2011), Cascais, Portugal October 2011.
2. A Fully Homomorhic Encryption Scheme, Craig Gentry, September 2009.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

Online Resources:

1. http://aws.amazon.com
2. http://code.google.com/appsengine
3. http://www.buyya.com/

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18CSE12

COMPUTER VISION
(PROFESSIONAL ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Linear Algebra and Probability, Digital Image Processing.

Course Objectives: The objectives of this course are
1. To understand the Fundamental Concepts Related To Multi-Dimensional Signal Processing.
2. To understand Feature Extraction algorithms.
3. To understand Visual Geometric Modeling and Stochastic Optimization.

Course Outcomes: On Successful completion of this course, student will be able to
1. Recognize the basic fundamentals of vision and describe the scope of challenges.
2. Develop algorithms to analyze feature detection and feature alignment.
3. Analyze images and videos for problems such as tracking and structure from motion.
4. Choose object, scene recognition and categorization algorithms for real time images.
5. Explain recovery of 3D structure of ill-posed scenes.
6. Apply various techniques to build computer vision applications.

UNIT - I

Introduction to Computer Vision and Image Formation: Introduction, Geometric primitives and transformations, Photometric image formation, Digital Camera image formation. **Image Processing:** Point operators, Linear filtering, More neighborhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations.

UNIT - II

Feature detection and matching: Points and patches, Edges, Lines. **Segmentation**: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts. **Feature-based alignment**: 2D and 3D feature-based alignment, Pose estimation.

UNIT - III

Structure from motion: Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, Constrained structure and motion. **Dense motion estimation:** Translational alignment, Parametric motion, Spline-based motion, Optical flow, Layered motion.

UNIT - IV

Recognition: Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding.

UNIT - V

3D Reconstruction: Shape from X, Active range finding, Surface representations, Point-based representations, volumetric representations, Model-based reconstruction, Recovering texture maps.

Text Books:
1. Richard Szeliski "Computer Vision: Algorithms and Applications", Springer-Verlag London Limited, 2011.
2. R. C. Gonzalez and R. E. Woods, "Digital Image Processing"; Addison Wesley, 2008.

Suggested Reading:
1. Robert J. Schallkoff, "Pattern Recognition: Statistical. Structural and Neural Approaches", John Wiley and Sons; 1992+.
2. D. A. Forsyth and J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
3. R. Hartley and A. Zisserman, "Multiple View geometry", Cambridge university Press, 2002.
4. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.
5. K. Fukunaga; "Introduction to Statistical Pattern Recognition", Second Edition, Academic Press, Morgan Kaufmann, 1990.

Online Resources:
1. CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline
2. Computer Vision Homepage: http://www2.cs.cmu.edu/afs/cs/project/cil/ftp/html/vision.html

18CSE13

SOFT COMPUTING
(PROFESSIONAL ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Fundamental Mathematics.

Course Objectives: The objectives of this course are
1. To learn various types of soft computing techniques and their applications.
2. To acquire the knowledge of neural network architectures, learning methods and algorithms.
3. To understand Fuzzy logic, Genetic algorithms and their applications.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand various soft computing techniques.
2. Analyze and design various learning models and Neural Network Architectures.
3. Apply the Neural Network Architecture for various Real time applications.
4. Understand approximate reasoning using fuzzy logic.
5. Analyze and design Genetic algorithms in different applications.
6. Apply soft computing techniques to solve different applications.

UNIT - I

Soft computing vs. Hard computing, Various types of soft computing techniques.

Artificial Neural Networks: Fundamental concepts, Evolution of neural networks, Basic models of artificial neural network, important terminologies of ANNs. McCulloch-Pitts neuron, linear separability, Hebb network.

UNIT - II

Supervised Learning Neural Networks: Perceptron networks, Adaptive linear neuron (Adaline), Multiple Adaptive linear neuron (Madaline), Back propagation network.

UNIT - III

Unsupervised Learning Neural Networks: Kohonen Self Organizing networks, Adaptive resonance theory. **Associate Memory Networks:** Bidirectional associative memory network, Hopfield networks.

UNIT - IV

Fuzzy Logic: Introduction to classical sets and Fuzzy sets, Fuzzy relations, Tolerance and equivalence relations, Membership functions, Defuzzification.

UNIT - V

Genetic Algorithms: Introduction, Basic operators and terminology, Traditional algorithm vs. genetic algorithm, Simple genetic algorithm, General genetic algorithm, Classification of genetic algorithm, Genetic programming, Applications of genetic algorithm.

Text Books:

1. S.N. Sivanandam& S.N. Deepa, "Principles of soft computing", Wiley publications, 2nd Edition, 2011.

Suggested Reading:

1. S. Rajasekaran& G.A. Vijayalakshmipai, "Neural Networks, Fuzzy logic & Genetic Algorithms, Synthesis & Applications", PHI publication, 2008.
2. LiMin Fu, "Neural Networks in Computer Intelligence", McGraw-Hill edition, 1994.
3. K.L.Du& M.N.S Swamy, "Neural Networks in a Soft Computing Framework", Springer International edition, 2008.
4. Simon Haykins, "Neural Networks a Comprehensive Foundation", PHI, second edition.
5. Goldberg, David E., "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, New Delhi, 2002.
6. N.P. Padhy and S.P. Simon, "Soft Computing: With Matlab Programming", Oxford University Press, 2015.

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc18_cs13/preview.

18CSE14

NETWORK AND SYSTEM ADMINISTRATION
(PROFESSIONAL ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System Concepts, Data Communications and Computer networks

Course Objectives: The objectives of this course are

1. To study about the operation of computers, servers and the networking
2. Familiarize the students with system and network administration tools.
3. Prepare the students to analyze the performance of system and network to resolve the issues

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and define the the basic system administration and networking tools
2. Illustrate system boot process, administration tools
3. Configure various services like mail, ftp, web hosting, security, use remote administration tools
4. Analyze and interpret log messages for troubleshooting the issues
5. Measure and evaluate the performance of system and network,
6. Write scripts to automate system administration process

UNIT - I

Networking Overview: History, Protocol Standards, Reference Models (ISO-OSI, TCP/IP), Windows and Linux networking basics, switching and routing basics.

Server Administration Basics: Server and Client Installation, Boot Process and Startup Services: Xinetd, Managing accounts: users, groups and other privileges, File Systems and Quota Management , Job Scheduling with cron, crontab, anacron and system log analysis, Process controlling and management, Online Server upgrade/update process.

UNIT - II

Network Configuration Basics: IPv4 and IPv6 addressing, Network Interface Configuration, Diagnosing Network startup issues, Linux and Microsoft, Firewall configuration, Network troubleshooting commands. **Dynamic Host Configuration Protocol (DHCP),** DHCP Principle, DHCP Server Configuration DHCP Options, Scope, Reservation and Relaying, DHCP Troubleshooting.

UNIT - III

Name Server and Configuration: DNS principles and Operations, Basic Name Server and Client Configuration, Caching Only name server, Primary and Slave Name Server, DNS Zone Transfers, dynamic Updates, delegation, DNS Server Security, troubleshooting.

Web and Proxy Server Configuration: HTTP Server Configuration Basics, Virtual Hosting, HTTP Caching, Proxy Caching Server Configuration, Proxy ACL, Proxy-Authentication Mechanisms, Troubleshooting.

UNIT - IV

FTP, File and Print Server: General Samba Configuration, SAMBA SWAT, NFS and NFS Client Configuration, CUPS configuration basics, FTP Principles, Anonymous FTP Server, Troubleshooting.

Mail Server basics: SMTP, POP and IMAP principles, SMTP Relaying Principles, Mail Domain Administration, Basic Mail Server Configuration, SPAM control and Filtering.

UNIT - V

Remote Administration and Management: Router Configuration, Webmin/ usermin, Team Viewer, Telnet, SSH, SCP, Rsync.

Text Books / Suggested Reading:

1. Thomas A. Limoncelli, Christina J. Hogan , Strata R. Chalup, “The Practice of System and Network Administration”, Pearson Education, Second Edition, 2012
2. Roderick W. Smith, “Advanced Linux Networking, Addison”, Wesley Professional (Pearson Education), 2002.
3. Tony Bautts, Terry Dawson, Gregor N. Purdy, “Linux Network Administrator’s Guide”, O’Reilly Publisher, Third Edition, 2005

Suggested readings:

1. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, "UNIX and Linux System Administration Handbook", Fifth Edition, 2017, Addison Wesley

Online resource:

1. https://study-ccna.com/
2. https://www.edx.org/course/it-support-networking-essentials

18CSE15

MOBILE COMPUTING
(PROFESSIONAL ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are:
1. Understand the concepts of mobile computing
2. Study network layer and transport layer protocols and Ad-Hoc networks.
3. Discuss about mobile platforms and application development.

Course Outcomes: On Successful completion of this course, student will be able to
1. Explain the basics of mobile telecommunication systems
2. Illustrate the generations of telecommunication systems in wireless networks
3. Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network
4. Explain the functionality of Transport and Application layers
5. Develop a mobile application using android/blackberry/ios/Windows SDK

UNIT-I

Introduction: Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA.

UNIT-II

Mobile Telecommunication System: Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security.

UNIT-III

Mobile Network Layer: Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.

UNIT-IV

Mobile Transport And Application Layer: Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

UNIT-V

Mobile Platforms And Applications: Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

Text Books:

1. Jochen Schiller, “Mobile Communications”, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi – 2012
3. Rajkamal, “Mobile Computing”, University press publications, 2014.

Suggested Reading :

1. Dharma Prakash Agarval, Qing and An Zeng, “Introduction to Wireless and Mobile systems”, Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
3. William.C.Y.Lee, “Mobile Cellular Telecommunications-Analog and Digital Systems”, Second Edition,TataMcGraw Hill Edition ,2006.
4. C.K.Toh, “AdHoc Mobile Wireless Networks”, First Edition, Pearson Education, 2002.

Online Resources :
1. Android Developers : http://developer.android.com/index.html
2. Apple Developer : https://developer.apple.com/
3. Windows Phone DevCenter : http://developer.windowsphone.com
4. BlackBerry Developer : http://developer.blackberry.com

18CSE16

FREE AND OPEN SOURCE SOFTWARE (FOSS)
(PROFESSIONAL ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are:
1. Familiarize the students with Open Source Technologies.
2. Expose students with OSS Projects, Advantages of Open Source.
3. Make the students understand the principles, methodologies, policies, licensing procedures and ethicsof FOSS.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Identify various FOSS tools, platforms, licensing procedures and development models, ethics
2. Describe various FOSS projects, development models and project management
3. Adapt to the usage of FOSS tools and technologies.
4. Distinguish between Proprietary and Open Source tools, development methods
5. Evaluate various Open Source projects like Linux, Apache, GIT
6. Practice Open Source principles, ethics and models.

UNIT - I

Introduction to Open Source: Open Source, need and principles of OSS, Open Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT – II

Fault Tolerant Design: **Principles and Open Source Methodology**- History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT – III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, LibreOffice.

UNIT – IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media

What Is A License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT – V

Open Source Ethics- Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:
1. Kailash Vadera, Bhavyesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press.

Suggested Reading:
1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, "Perspectives on Free and Open Source Software", MIT press.

Online Resources:
1. https://fossee.in/
2. https://opensource.com
3. https://www.gnu.org/

Professor and Head Department

Choice Based Credit System (CBCS)

Name of the Programme (UG):

B.E Syllabus for Semester VII and VIII - Semester

With effect from 2019 - 2020

Specialization /Branch: Computer Science and Engineering

Chaitanya Bharathi Institute of Technology (A)
Chaitanya Bharathi (P.O), Gandipet
Hyderabad-500075, Telangana State.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTION AND EXAMINATION

VII-Semester of B.E under CBCS

COMPUTER SCIENCE AND ENGINEERING

SEMESTER-VII

Sl.No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L/T	Scheme of Instruction: Hours per week P/D	Scheme of Examination: Duration of SEE in Hours	Maximum Marks CIE	Maximum Marks SEE	Credits
THEORY								
1	16CSC 33	Data Science and Big Data Analytics	3	-	3	30	70	3
2	16CSC 34	Free and Open Source Software	3	-	3	30	70	3
3	16CSC 35	Distributed and Cloud Computing	3	-	3	30	70	3
4	16CSC 36	Machine Learning	3/1	-	3	30	70	4
5		Elective-IV	3	-	3	30	70	3
6		Elective-V	3	-	3	30	70	3
PRACTICALS								
7	16CSC 37	DSBDA Lab	-	3	3	25	50	2
8	16CSC 38	ML Lab	-	3	3	25	50	2
9	16CSC 39	Project Seminar	-	3	3	50	-	2
TOTAL			**19**	**9**		**280**	**520**	**25**

ELECTIVE-IV	
16CSE 10	Deep Learning
16CSE 11	Design Patterns
16CSE 12	Nature Inspired Algorithm
16CSE 13	System and Network Administration

ELECTIVE-V (OE1)	
16CEO 02	Disaster Mitigation and Management
16MEO 01	Entrepreneurship
16MEO 06	Research Methodologies
16EGO 02	Gender Sensitization

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

NPTEL Courses (Enrollment :15-05-2019 to 29-07-2019)				
Exam Registration (Open and Close Dates) : 1-Jun-19 to 23-09-2019 10.00 am				
Courses	**Elective**	**Course Start Date**	**Course End Date**	**Exam Date**
Software Project Management	Elective - IV	29-07-2019	18-10-2019	02-11-2019
Ethical Hacking		29-07-2019	18-10-2019	02-11-2019
Natural Language Processing		29-07-2019	18-10-2019	02-11-2019
Block Chain Architecture Design and Use cases	Elective - V	29-07-2019	18-10-2019	03-11-2019
Social Networks		29-07-2019	18-10-2019	02-11-2019
Computer Vision		29-07-2019	18-10-2019	02-11-2019

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Assessment Procedure				
Course (in terms of credits)	**Continuous Internal Evaluation (Marks)**	**Semester end Examination (Marks)**	**Remarks**	**Duration of Semester End Examination**
Three(3)Credits/ Four(4)credits	30*	70**	Theory Course/ Engg . Graphics	3 Hours
Two(2) Credits	25	50	Lab Course/Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
One(1) Credit	50	-	Mini Project	-

* Out of 30 CIE, 10 marks are allotted for slip-tests (Three slip tests will be conducted, each of ten marks, and average of best two is considered) and the remaining 20 marks are based on the average of two tests, weightage for each test is 20 marks.

** The question paper will be in two parts, Part-A and Part-B. Part A is compulsory and contains short answer questions covering the entire syllabus, and carries 20 marks. Part-B carries 50 marks and covers all the units of the syllabus (student has to answer five out of seven questions).

Note: A course that has CIE but no SEE as per scheme is treated as PASS/FAIL for which pass marks are **50%** of CIE.

A candidate has earned the credits of a particular course, if he/she secures not less than the minimum marks/ grade as prescribed. Minimum pass marks in the SEE plus CIE shall be 40% for theory courses/subjects and **50%** for lab courses /Mini Project/ Project.

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16CSC 33

DATA SCIENCE AND BIG DATA ANALYTICS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre Requisites: DBMS, Probability and Statistics

Course Objectives: The main objectives of this course are:
1. Introduce a data analytics problem solving framework
2. Develop technical skills in probability modeling and statistical inference for the practical application of statistical methods.
3. Use existing and develop new statistical tools for data science problems across different applied domains.

Course Outcomes: On successful of this course student will be able to:
1. Understands various phases of the data analytics life cycle.
2. Apply statistical methods to data for inferences.
3. Analyze data using Classification, Graphical and computational methods.
4. Understands Big Data technologies and NOSQL.
5. Analyze various types of data using Data Analytics Techniques.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	-	-	-	1	-	-	-	-	-	-	1	-
2	3	1	2	2	2	1	-	-	2	1	1	2	1	2
3	3	3	2	3	3	-	-	-	2	1	-	3	3	3
4	3	-	-	-	3	-	-	-	-	-	-	-	2	3
5	3	3	2	2	3	-	-	-	-	-	1	2	3	3

UNIT - I

Data Analytics Life cycle: Data Analytics Life cycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalise, Exploratory Data Analysis, Statistical Methods for Evaluation, ANOVA.

UNIT - II

Overview of Supervised Learning: Variable Types and Terminology, Two Simple Approaches to Prediction: Least Squares and Nearest Neighbors, Model Selection and Bias–Variance Tradeoff. **Association Analysis:** Association rules, Apriori algorithm, FP-Growth Technique

UNIT - III

Time Series Analysis: Overview of Time Series Analysis, ARIMA Model; **Text Analysis:** Text Analysis Steps, Stop Word Removal, Tokenization, Stemming and Lemmatization, Representing Text: Term-Document Matrix, Term Frequency--Inverse Document Frequency (TFIDF).

UNIT - IV

Introduction to Big Data: Defining big data, 4 V's of big data, Big data types, Analytics, Examples of big data, Big data and Data Risk, Big data technologies, benefits of big data, Crowd sourcing analytics; **Hadoop Distributed File Systems:** Architecture of Apache Hadoop HDFS and other File Systems, HDFS File Blocks, HDFS File Commands

UNIT - V

NoSQL Data Management: Types of NOSQL data bases, Benefits of NO SQL, **Map Reduce:** Introduction, Map reduce example, Job Tracker, Map Operations. **Data Stream Mining:** The stream data model, streaming applications, continuous query processing and optimization, Distributed query processing.

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Text Books:

1. EMC Education Services "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publishers, 2012.
2. Hastie, Trevor, et al., "The elements of statistical learning: Data Mining, Inference, and Prediction", Vol. 2. No. 1. New York: Springer, 2009.
3. V.K. Jain,"Big Data & Hadoop", Khanna Publishing House,2017.

Suggested Reading:

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012
2. Mark Gardener, "Beginning R The statistical Programming Language", Wiley, 2015.
3. Han, Kamber, and J Pei, "Data Mining Concepts and Techniques", 3rd edition, Morgan Kaufman, 2012.
4. Big Data Black Book, DT Editorial Services, Wiley India
5. V.K. Jain, "Data Science & Analytics", Khanna Publishing House Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, ISBN: 978-93-86173454.
6. Montgomery, Douglas C., and George C. Runger John, "Applied statistics and probability for engineers", Wiley & Sons, 6th edition, 2013.

16CSC 34 **FREE AND OPEN SOURCE SOFTWARE**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Familiarity with Open Source Technologies
2. Study some FOSS Projects to under the principles, methodologies of FOSS.
3. Understand the policies, licensing procedures and ethics of FOSS.

Course Outcomes: On successful of this course student will be able to:
1. Differentiate between Open Source and Proprietary software and Licensing.
2. Recognize the applications, benefits and features of Open Source Technologies.
3. Understand and demonstrate Version Control System along with its commands.
4. Gain knowledge to start, manage open source projects.
5. Understand and practice the Open Source Ethics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	2	2	2	-	-	-	2	1	1	1	3
2	2	2	3	3	2	2	1	1	1	1	2	2	1	3
3	3	3	3	3	3	3	1	-	2	2	3	1	2	3
4	3	3	3	2	3	3	2	2	2	3	2	3	1	3
5	3	3	2	2	2	2	2	3	1	2	2	2	1	3

UNIT - I

Introduction to Open Source: Open Source, need and principles of OSS, Open Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT - II

Fault Tolerant Design: **Principles and Open Source Methodology**- History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT - III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, Libre Office.

UNIT - IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media

What Is A License, Creation of our own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT - V

Open Source Ethics: Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:

1. Kailash Vadera, Bhavyesh Gandhi, “Open Source Technology”, University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, “Open Source Technology and Policy”, Cambridge University Press, 2008

Suggested Reading:

1. Wale Soyinka, “Linux Administration- A beginner’s Guide”, Tata McGraw Hills, 2009
2. Andrew M. St. Laurent, “Understanding Open Source and Free Software Licensing”, O'Reilly Media, 2004.
3. Dan Woods, Gautam Guliani, “Open Source for the Enterprise”, O'Reilly Media, 2005.
4. Bernard Golden, “Succeeding with Open Source”, Addison-Wesley Professional,2004.
5. Clay Shirky and Michael Cusumano, “Perspectives on Free and Open Source Software”, MIT press, 2005.

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16CSC 35 **DISTRIBUTED AND CLOUD COMPUTING**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To present the principles underlying the function of distributed computing
2. To understand key mechanisms of remote execution
3. To impart the fundamentals and essentials of Cloud Computing.
4. To enable students explore cloud computing driven real time systems

Course Outcomes: On successful of this course student will be able to:
1. Understand the characteristics and models in distributed computing.
2. Define Cloud Computing and related concepts and describe the characteristics, advantages, risks and challenges associated with cloud computing.
3. Explain and characterize various cloud services and deployment models, virtualization techniques.
4. Illustrate the concepts of cloud storage and demonstrate their use.
5. Analyze various cloud programming models and apply them to solve problems

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	1	2	1	-	-	-	-	-	-	-	-
2	3	3	2	1	1	1	-	-	-	-	-	-	-	-
3	3	2	3	2	1	1	-	-	-	-	-	-	-	-
4	3	3	2	1	1	1	-	-	-	-	-	-	-	-
5	3	3	3	2	1	1	-	-	-	-	-	-	-	-

UNIT - I

Characterization of Distributed Systems: Introduction, Examples of distributed systems, Resource sharing and the web, Challenges, **System Models:** Introduction, Architectural models, Fundamental models, **Interprocess Communication:** Introduction, The API for the internet protocols, External data representation and marshalling, Client server communication, Group communication, Interprocess communication in UNIX

UNIT - II

Distributed objects and Remote Invocation: Introduction, Communication between distributed objects, Remote procedure call, Events and notifications, **Time and Global States:** Introduction, Clocks, events and process states, Synchronizing physical clocks, Logical time and logical clocks, Global states, distributed debugging, **Coordination and Agreement:** Introduction, Distributed mutual exclusion, Elections, Multicast communication, Consensus and related problems.

UNIT - III

Introduction to Cloud Computing: Scalable Computing Over the Internet, System Models for Distributed and Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, **Virtual Machines and Virtualization of Clusters and Data Centers:** Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT - IV

Cloud computing architecture over Virtualized Data Centers: Data-Center design and Interconnection networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, GAE, AWS, Azure, Inter-cloud Resource Management.

UNIT - V

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, **Common Standards in Cloud Computing:** The Open Cloud Consortium, the Distributed Management Task Force, Standards for Messaging, Internet Messaging Access Protocol (IMAP)

Text Books:

1. Colouris, Dollimore, Kindberg, “Distributed Systems concepts and Design”,5th Ed. Pearson Education, 2016.
2. Kai Hwang. Geoffrey C.Fox, Jack J. Dongarra, “Distributed and Cloud Computing From Parallel Processing to the Internet of Things”, Elsevier, 2012.

Suggested Readings:

1. Sunita Mahajan and Seema Shah,"Distributed Computing", Oxford University Press, 2013.
2. S.Ghosh, Chapman and Hall/CRC, ”Distributed Systems”, Taylor & Francis Group, 2010.
3. Pradeep K.Sinha, “Distributed Operating Systems Concepts and Design”, PHI,
4. Andrew S. Tanenbaum, Van Steen, “Distributed Systems”, Pearson Education, 2002.

16CSC 36 **MACHINE LEARNING**

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Pre-requisites: Linear Algebra and Probability theory basics

Course Objectives: The main objectives of this course are:
1. Understand the need and elements of Machine Learning
2. Study various machine learning techniques
3. Design solutions for real world problems using machine learning techniques

Course Outcomes: On successful of this course student will be able to:
1. Define the basic concepts related to Machine Learning
2. Recognize the underlying mathematical relationships within and across Machine Learning algorithms and their paradigms
3. Determine the various applications of machine learning
4. Model the problems using various machine learning techniques
5. Design and develop solutions to real world problems using Machine Learning Algorithms
6. Evaluate and interpret the results of the various machine learning techniques

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	3	-	-	-	-	-	-	-	3	3	2
2	3	3	1	3	-	-	-	-	-	-	-	3	3	2
3	3	3	1	3	-	-	-	-	-	-	-	3	3	2
4	3	3	1	3	-	-	-	-	-	-	-	3	3	2
5	3	3	1	3	3	-	-	-	-	-	-	3	3	2
6	3	3	1	3	3	-	-	-	-	-	-	3	3	2

UNIT - I

Introduction to Machine Learning: Introduction, Classic and Adaptive machines, learning types, deep learning, bio-inspired adaptive systems, Machine Learning and big data; **Elements of Machine Learning:** Data formats, Learnability, Statistical learning concepts, Class balancing, Elements of Information theory

UNIT - II

Feature Selection and Feature Engineering: Data sets, Creating training and test sets, managing categorical data, missing features, data scaling and normalization, Withering, Feature selection and filtering, PCA, Visualization of high-dimensional datasets; **Regression Algorithms**: Linear models for regression, Regression types, **Linear Classification Algorithms:** Linear classification, logistic regression, grid search, classification metrics, ROC curve

UNIT - III

Naïve Bayes and Discriminant Analysis: Bayes theorem, Naïve Bayes classifiers, Discriminant analysis; **Support Vector Machines**: Linear SVM, Kernel-based classification; **Decision Trees and Ensemble Learning**: Binary Decision trees, Introduction to Ensemble Learning-Random Forests, AdaBoost, Gradient Tree Boosting, Voting classifier

UNIT - IV

Clustering Fundamentals: Basics, k-NN, Gaussian mixture, K-means, Evaluation methods, DBSCAN, Spectral Clustering, Hierarchical Clustering; **Introduction to Neural Networks**: Introduction to deep learning, MLPs with Keras, deep learning model layers, introduction to Tensorflow

UNIT - V

Machine Learning Architectures: Data collection, Normalization and regularization, Dimensionality reduction, Data augmentation, Modeling/Grid Search/Cross-validation, Visualization, GPU support, introduction to distributed architectures, Scikit-learn tools for ML architectures, pipelines, Feature unions

Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2nd Edition, Packt, 2018,
2. Tom Mitchel “Machine Learning”, Tata McGraW Hill, 2017

Suggested Reading:

1. Abhishek Vijavargia “Machine Learning using Python”, BPB Publications, 1st Edition, 2018
2. Reema Thareja “Python Programming”, Oxford Press, 2017
3. Yuxi Liu, “Python Machine Learning by Example”, 2nd Edition, PACT, 2017

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.htm
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.geeksforgeeks.org/machine-learning/

16CSC 37 DATA SCIENCE AND BIG DATA ANALYTICS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The main objectives of this course are:
1. To introduce practical exposure on basic data science techniques.
2. To develop the skills in using data science tools for solving data intensive problems.
3. To explore the fundamental concepts of big data analytics.

Course Outcomes: On successful of this course student will be able to:
1. Implement and apply data science algorithms to solve problems
2. Implement various the exploratory data analysis techniques to understand the data.
3. Work with big data platform and explore the big data analytics techniques business applications.
4. Design efficient algorithms for analyzing the data from large volumes.
5. Analyze the HADOOP and Map Reduce technologies associated with big data analytics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	2	2	2	1	-	-	2	1	1	2	1	2
2	3	1	2	2	2	1	-	-	2	1	1	2	1	2
3	3	1	1	-	-	2	-	-	-	-	-	1	-	-
4	3	3	2	2	3	-	-	-	-	-	1	2	3	3
5	3	3	2	2	3	-	-	-	-	-	1	2	3	3

List of Experiments:
1. Identification and Installation of required softwares/Technologies (Python/modules)
2. Important modules for statistical methods: Numpy, Scipy, Pandas etc.
3. Demonstration of Inferential Statistics-sampling, Hypothesis testing-Z/t tests
4. Demonstration of statistical methods Anova, Correlation and Chi-square
5. Important modules for Machine Learning: (ScikitLearn, Statsmodels, SciPy, NLTK etc.)
6. Demonstration of Sentiment analysis using NLTK
7. Time Series Forecasting with ARIMA model
8. Installation of Big data technologies and building a Hadoop cluster
9. Experiment for data loading from local machine to Hadoop
10. Demonstration of Map Reduce concept
11. Experiment for loading data from RDBMS to HDFS by using SQOOP
12. Demonstration of developing and handling a NOSQL database with HBase

Text Books:

1. Tom White, “Hadoop: The Definitive Guide: Storage and Analysis at Internet Scale”, 4th Edition, O'Reilly Publications, 2015.
2. Samir Madhavan, “Mastering Python for Data Science”, Packt Publishing, 2015.
3. Seema Acharya, Subhasinin Chellappan, “Big Data and Analytics”, Wiley publications.
4. Big Data, Black Book TM , Dream Tech Press, 2015 Edition

16CSC 38 MACHINE LEARNING LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The main objectives of this course are:

1. Make use of Data sets in implementing the machine learning algorithms.
2. Implement the machine learning concepts and algorithms in any suitable language of choice.
3. Make use of real world data to implement machine learning models.

Course Outcomes: On Successful completion of this course, student will be able to:

1. Understand complexity of Machine Learning algorithms and their limitations.
2. Identify and understand modern tools that are useful in data analysis
3. Implement analyze Machine Learning algorithms
4. Use Keras and Tensorflow packages to implement the solutions
5. Design and develop solutions to real world problems using ML techniques
6. Evaluate and interpret the results of the various machine learning techniques

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	2	-	-	-	-	-	-	-	1	2	2
2	3	2	-	3	2	-	-	-	-	-	-	2	2	2
3	3	3	1	3	2	-	-	-	-	-	-	2	3	3
4	3	3	1	3	3	-	-	-	-	-	-	2	3	3
5	3	3	1	3	3	-	-	-	-	-	-	2	3	3
6	3	3	3	3	3	-	-	-	-	-	-	2	3	3

LIST OF EXPERIMENTS:

1. Identification and Installation of python environment towards the machine learning, installing python modules/Packages Import Scikitlearn, Keras and Tensorflows etc.
2. Demonstration of decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a News sample.
3. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate datasets.
4. Demonstration of Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
5. Demonstration of Bayesian network by considering standard dataset, by using Java/Python ML library classes/API.
6. Demonstration of Clustering algorithms - k-Means, K-Nearest Neighbor a, Agglomerative and DBSCAN to classify for the standard datasets. Print both correct and wrong predictions using Java/Python ML library classes can be used for this problem.
7. Experiment the non-parametric locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graph
8. Demonstration of SVM and use for character recognition task..
9. Build the decision tree classifier compare its performance with ensemble techniques like random forest. Demonstrate it with different decision trees.
10. Experiments on mobile Robots
11. Line, path following
12. Autonomous distance traversing
13. Autonomous distance traversing using GPS
14. Miniature self-driving car using machine learning

Text Books:

1. Giuseppe Bonaccorso, "Machine Learning Algorithms", 2017, Packt Publishing.

Professor and Head Department

16CSC 39 PROJECT SEMINARS

Instruction	3 Hours per week
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

Course Outcomes:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a Department Review Committee.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	--	--	--	2	--	--	--	--	--	2	2	2
2	2	--	--	--	--	2	--	--	--	--	--	2	3	3
3	2	--	--	--	--	--	--	2	--	2	--	--	--	--
4	--	--	--	--	1	--	--	2	--	3	--	--	--	--
5	--	--	--	--	1	--	--	2	--	3	--	--	--	--

Guidelines for the award of Marks: **(Max. Marks: 50)**

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Review Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

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16CSE 10 **DEEP LEARNING (ELECTIVE-IV)**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To learn Deep learning techniques and their applications.
2. To acquire the knowledge of neural network architectures, Deep learning methods and algorithms.
3. To understand CNN and RNN algorithms and their applications.

Course Outcomes: On successful of this course student will be able to:
1. Understand various learning models.
2. Design and develop various Neural Network Architectures.
3. Understand approximate reasoning using Convolution Neural Networks.
4. Analyze and design Deep learning algorithms in different applications.
5. Ability to apply CNN and RNN techniques to solve different applications.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	-	-	-	-	-	-	1	-	-	-	-
2	1	1	2	2	2	-	-	-	-	-	-	-	2	3
3	3	1	1	2	-	-	-	-	-	1	-	-	2	2
4	-	2	1	-	-	-	-	-	-	1	-	1	3	3
5	1	2	1	-	-	-	-	-	-	-	-	1	2	2

UNIT - I

Introduction: Historical Trends in Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm. Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feed forward Neural Networks, Representation Power of Feed forward Neural Networks

UNIT - II

Feed Forward Neural Networks, Back propagation, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMS Prop, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis Principal Component Analysis and its interpretations, Singular Value Decomposition

UNIT - III

Auto encoders : relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Contractive auto encoders, **Regularization:** Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization

UNIT - IV

Convolutional Neural Network: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types. LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Back propagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks

UNIT – V

Recurrent Neural Networks, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs, Encoder Decoder Models, Attention Mechanism, Attention over images

Text Books:
1. Goodfellow. I., Bengio. Y. and Courville. A., “Deep Learning”, MIT Press, 2016.

Suggested Reading:
1. Tom M. Mitchell, "Machine Learning", MacGraw Hill, 1997.
2. Stephen Marsland, "Machine Learning - An Algorithmic Perspective ", CRC Press, 2009.
3. LiMin Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill edition, 1994.

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc18_cs41/

16CSE 11 DESIGN PATTERNS (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To understand the fundamental concepts of C++ and the design patterns,
2. User interfaces, standards of designing a document editor.
3. To understand the Structural Patterns, and the Behavioral pattern.
4. To learn about the dynamics of the design patterns.

Course Outcomes: On successful of this course student will be able to:

1. Apply formal notations of C++, design and develop pattern of user choice and accomplish UI and design an efficient editor.
2. Determine the prototypes, abstract factory to design and develop catalog pattern.
3. Apply the behavioral modeling principles design the behavioral pattern for a system.
4. Use design patterns for real world situations.
5. List consequences of applying each pattern.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	3	2	2	3	3	3	3	3	2	3
2	3	3	3	3	3	2	2	2	2	3	3	3	2	2
3	3	2	3	3	2	2	3	3	3	3	3	3	3	3
4	3	3	3	3	3	3	2	3	3	2	3	3	3	3
5	3	2	2	2	2	3	2	3	3	2	3	3	2	2

UNIT - I

Review of Formal Notations and Foundation Classes in C++: Class Diagram, Object Diagram, Interaction Diagram Examples, List, Iterator, List Iterator, Point, Rect, Coding in C++. **Introduction to Design Patterns:** Design Pattern Definition, Design Patterns in Small Talk MVC, Describing Design Patterns, Catalog of Design Patterns, Organizing The Catalog, Solving of Design Problems Using Design Patterns, Selection of A Design Pattern, Use of Design Patterns.

UNIT - II

Designing a Document Editor: A Case Study: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look and Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation.

UNIT - III

Design Patterns Catalog: Creational Patterns, Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

Structural Patterns-1: Adapter, Bridge, Composite, Decorator. Structural Patterns-2 and Behavioral Patterns-1: Structural Patterns: Façade, Flyweight, Proxy, Discuss of Structural Patterns.

UNIT - IV

Behavioral Patterns: Chain of Responsibility Command, Interpreter. **Behavioral Patterns-2:**Iterator, Mediator, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns.

UNIT - V

Behavioral Patterns-3: State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns, Expectations from Design Patterns.

Text Books:

1. Gamma, Belm, Johnson, "Design Patterns: Elements of Reusable Object Oriented Software", 1995, Pearson Education ISBN:10:0201633612.
2. Eric Freeman, "Head First Design Patterns", Oreilly-SPD,ISBN:10:0596007124.

Suggested Reading:

1. Cooper, "Java Design Patterns", Pearson Education, ISBN:6201-48539-7.
2. Horstmann, "Object Oriented Design and Patterns", Wiley, ISBN:10:0471744875.

Online Resources:

1. shop.oreilly.com/product/9780596007126.do
2. ww.amazon.com/Design-Patterns-Elements.../dp/0201633612

16CSE 12 NATURE INSPIRED ALGORITHM (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Design and Analysis of Algorithms

Course Objectives: The main objectives of this course are:
1. Understand the fundamentals of nature inspired techniques which influence computing
2. Study the Swarm Intelligence and Immuno computing techniques
3. Familiarize the DNA Computing

Course Outcomes: On successful of this course student will be able to:
1. Understand The basics Natural systems
2. Learn the concepts of Natural systems and its applications
3. Understand different basic Natural systems functions(operations)
4. Understand Natural design considerations
5. Apply to real world problems

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	-	3	-	-	-	-	-	-	--	-	-	-	-
4	-	3	3	-	-	-	-	-	-	-	-	-	2	-
5	-	3	2	-	-	-	-	-	-	-	--	-	2	-

UNIT - I

Introduction: From Nature to Nature Computing , Philosophy , Three Branches: A Brief Overview, Individuals, Entities and agents - Parallelism and Distributivity Interactivity ,Adaptation- Feedback-Self-Organization-Complexity, Emergence and ,Bottom-up Vs Top-Down- Determination, Chaos and Fractals.

UNIT - II

Computing Inspired by Nature: Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms , Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming

UNIT - III

Swarm Intelligence: Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO)

UNIT - IV

Immuno computing: Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding , Immune Network Theory- Danger Theory, Evaluation Interaction- Immune Algorithms , Introduction – Genetic algorithms , Bone Marrow Models , Forest's Algorithm**,** Artificial Immune Networks

UNIT - V

Computing With New Natural Materials: DNA Computing: Motivation, DNA Molecule , Adleman's experiment , Test tube programming language, Universal DNA Computers, PAM Model , Splicing Systems , Lipton's Solution to SAT Problem , Scope of DNA Computing, From Classical to DNA Computing

Text Books:

1. Leandro Nunes de Castro, “Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications”, Chapman & Hall/ CRC, Taylor and Francis Group, 2007
2. Floreano D. and Mattiussi C., “Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies”, MIT Press, Cambridge, MA, 2008

Suggested Reading:

1. Albert Y.Zomaya, “Handbook of Nature-Inspired and Innovative Computing”, Springer, 2006.
2. Marco Dorrigo, Thomas Stutzle, “Ant Colony Optimization”, PHI,2005

Professor and Head Department

16CSE 13 SYSTEM AND NETWORK ADMINISTRATION (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System Concepts, Computer networking basics

Course Objectives: The main objectives of this course are:

1. Understand the basic operation of system and networking.
2. Familiarize the students with system and network administration.
3. Analyze the system and network performance, issues.

Course Outcomes: On successful of this course student will be able to:

1. Understand the basics of systems administration and networking.
2. Identify and apply various system network administration tools/commands.
3. Configure various services like mail, ftp, web hosting, security.
4. Analyze various system and network performance and issues.
5. Troubleshoot various system and network services.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	2	1	1	-	-	1	2	1	2	3	2
2	3	3	3	3	3	2	1	-	2	2	2	3	3	3
3	2	2	2	2	3	1	1	-	2	2	1	2	2	2
4	2	3	3	2	2	1	1	-	1	3	2	2	3	2
5	2	3	2	3	2	-	-	-	1	2	1	2	2	1

UNIT - I

Networking Overview: Protocol standards, Reference Models (ISO-OSI, TCP/IP), Networking basics of Windows and Linux, switching and routing basics

Server Administration Basics: Server and Client Installation, boot process and startup Services: Xinetd, Managing user and group accounts, File Systems and Quota Management , Job Scheduling with *cron, crontab, anacron* and system log analysis, Process controlling and management, online server updation process.

UNIT - II

Network Configuration Basics: IPv4 and IPv6 addressing, Network Interface Configuration, Diagnosing Network startup issues, Linux and Microsoft, Firewall configuration, Network troubleshooting commands

Dynamic Host Configuration Protocol (DHCP), DHCP Principle, DHCP Server Configuration, DHCP Options, Scope, Reservation and Relaying and troubleshooting

UNIT - III

Name Server and Configuration: DNS principles and Operations, Basic Name Server and Client Configuration, Caching Only name server, Primary and Slave Name Server, DNS Zone Transfers, dynamic updates, delegation, DNS Server Security, Troubleshooting

Web and Proxy Server Configuration: HTTP Server Configuration Basics, Virtual Hosting, HTTP Caching, Proxy Caching Server Configuration, Proxy ACL, Proxy-Authentication Mechanisms, Troubleshooting

UNIT - IV

FTP, File and Print Server: General Samba Configuration, SAMBA SWAT, NFS and NFS Client Configuration, CUPS configuration basics, FTP Principles, Anonymous FTP Server, Troubleshooting

Mail Server basics: SMTP, POP and IMAP principles, SMTP Relaying Principles, Mail Domain Administration, Basic Mail Server Configuration, SPAM control and Filtering

UNIT - V

Remote Administration and Management: Router Configuration, webmin/usermin, Team Viewer, Telnet, SSH, SCP, Rsync

Text Books

1. Thomas A. Limoncelli, Christina J. Hogan , Strata R. Chalup,“The Practice of System and Network Administration”, Second Edition, 2007
2. Roderick W. Smith, “Advanced Linux Networking”, Addison-Wesley Professional (Pearson Education), 2002.
3. Tony Bautts, Terry Dawson, Gregor N. Purdy, “Linux Network Administrator’s Guide”, O’Reilly, Third Edition, 2005

Online Resources:

1. https://nptel.ac.in/courses/106106157/25
2. https://onlinecourses.nptel.ac.in/noc17_ee15/preview

16CEO 02 DISASTER MITIGATION AND MANAGEMENTELECTIVE-V (OE1)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters.
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases in a disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions.

Course Outcomes: On Successful completion of this course, student will be able to

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels.
2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management.
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same.
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2	2	2	1	2	2	2	1	1	
2	1	1	2	2	2	3	3	1	2	1	1	1		2
3	2	2	2	2	2	2	3	2	1	1	2	1	1	
4	2	2	2	2	3	2	1	1	1	1	1	1		2
5	2	1	2	1	2	3	1	2	2	2	2	1	2	

UNIT - I

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT - II

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT - III

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storied buildings.

Professor and Head Department

UNIT - IV

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT - V

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni, "Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh, "Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs. Government of India, "National disaster management plan, Part I and II".
2. K. K. Ghosh," Disaster Management", APH Publishing Corporation, 2006.
3. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

Online Resources:

1. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)

16MEO 01 ENTREPRENEURSHIPELECTIVE-V (OE1)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Course Outcomes: On Successful completion of this course, student will be able to

1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	1	2	1	2	2	2	2	2	2	2	1
2	2	2	2	2	2	2	-	1	2	2	2	1
3	2	2	2	2	2	2	1	1	2	2	2	1
4	3	3	1	2	2	-	-	-	1	1	3	2
5	1	1	1	1	2	-	1	1	1	1	2	2

UNIT - I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT - II

Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT - III

Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT - IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT - V

Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, “Dynamics of Entrepreneurial Development and Management”, Himalaya Publishing House, 1997.
2. Prasanna Chandra, “Project-Planning, Analysis, Selection, Implementation and Review”, Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, “Entrepreneurial Development”, S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, “Entrepreneurship”, 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, “First Things First”, Simon and Schuster Publication, 1994.
3. Sudha G.S., “Organizational Behavior”, National Publishing House, 1996.

16MEO 06 RESEARCH METHODOLOGIES ELECTIVE-V (OE1)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To make the students to formulate the research problem
2. To identify various sources for literature review and data collection.
3. To prepare the research design
4. To equip the students with good methods to analyze the collected data
5. To explain how to interpret the results and report writing

Course Outcomes: On successful of this course student will be able to:
1. Define research problem
2. Review and asses the quality of literature from various sources.
3. Understand and develop various research designs.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Improve the style and format of writing a report for technical paper/ Journal report

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	-	1	-	-	1	2	2	2	1	2
2	-	2	1	2	1	-	-	-	-	2	2	2	-	2
3	1	2	3	2	2	1	-	-	1	2	-	1	1	2
4	2	2	-	3	2	-	-	-	-	2	1	1	2	2
5	-	1	-	-	1	1	-	-	1	3	-	2	-	1

UNIT – I

Research Methodology: Objectives and Motivation of Research, Types of Research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research Approaches, Significance of Research, Research Methods verses Methodology, Research process, Criteria of Good Research, Problems Encountered by Researchers in India, Technique involved in defining a problem.

UNIT–II

Literature Survey: Importance of Literature Survey, Sources of Information-primary, secondary, tertiary, Assessment of Quality of Journals and Articles, Information through Internet.

UNIT – III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Steps in sample design

UNIT – IV

Data Collection: Collection of primary data, Secondary data, Measures of central tendency-mean, mode, median, Measures of dispersion- Range, Mean deviation, Standard deviation, Measures of asymmetry (skewness), Important parametric tests -z, t, F, Chi-Square, ANOVA significance

UNIT – V

Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation- Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

Text Books:
1. C.R Kothari, "Research Methodology, Methods & Technique", New Age International Publishers, 2004.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011

Suggested Reading:
1. Vijay Upagade and Aravind Shende, "Research Methodology", S. Chand & Company Ltd., 2009
2. G. Nageswara Rao, "Research Methodology and Quantitative methods", BS Publications, 2012.
3. Ratan Khananabis and Suvasis Saha, "Research Methodology", Universities Press, Hyderabad, 2015

16EGO 02

GENDER SENSITIZATION
ELECTIVE-V (OE1)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course Outcomes: On successful of this course **s**tudent will be able to:

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	1	-	1	-	-	-	1	1	-
2	-	-	-	-	-	-	-	1	1	1	-	1	1	-
3	-	-	-	-	-	1	-	1	1	1	-	1	1	-
4	-	-	-	-	-	1	-	1	1	1	-	1	1	-
5	-	-	-	-	-	1	-	1	1	1	-	1	1	-

UNIT – I

Understanding Gender: Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1) **Socialization:** Making Women, Making Men (*Towards a World of Equals*: Unit -2)
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II

Gender and Biology: Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4) Declining Sex Ratio. Demographic Consequences. **Gender Spectrum:** Beyond the Binary (*Towards a World of Equals*: Unit -10) Two or Many? Struggles with Discrimination.

UNIT – III

Gender and Labour: Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3) "My Mother doesn't Work." "Share the Load." **Women's Work**: Its Politics and Economics (*Towards a World of Equals*: Unit -7) Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV

Issues of Violence: Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6) Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu*". **Domestic Violence:** Speaking Out (*Towards a World of Equals*: Unit -8) Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice. Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11) Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V

Gender: Co – Existence : Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12) Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

Text Books:

1. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, 2015.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. **"I Fought For My Life…and Won."** Available online at:
3. http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Online Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTION AND EXAMINATION
VIII-Semester of B.E under CBCS
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-VIII

Sl.No	Syllabus Ref. No	SUBJECT	Scheme of Instruction: Periods per Week		Scheme of Examination			Credits
			L/T	P/D	Duration Credits of SEE in Hours	Maximum Marks: CIE	Maximum Marks: SEE	
THEORY								
1	16CSE XX	Elective-VI	3	-	3	30	70	3
2	16CSE XX	Elective-VII	3	-	3	30	70	3
3	6MT/ME/PY OXX	Elective-VIII	3	-	3	30	70	3
PRACTICALS								
7	16CSC 40	Seminar	-	3	3	50	-	2
8	16CSC 41	Project	-	6	3	50	100	6
		TOTAL	**9**	**9**		**190**	**310**	**17**

ELECTIVE-VI		ELECTIVE-VII	
16CSE 14	Cyber Security	16CSE 18	Bioinformatics
16CSE 15	Optimization Techniques	16CSE 19	Human Computer Interaction
16CSE 16	Natural Language Processing	16CSE 20	Social Networking and its Impact
16CSE 17	Virtual Reality	16CSE 21	Blockchain Technology

ELECTIVE-VIII (OE2)	
16MTO 04	Quantum Computing
16MEO 02	Robotics
16MEO 04	Intellectual Property Rights
16PYO 01	History of Science and Technology

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Assessment Procedure				
Course (in terms of credits)	**Continuous Internal Evaluation (Marks)**	**Semester end Examination (Marks)**	**Remarks**	**Duration of Semester End Examination**
Three(3)Credits/ Four(4)credits	30*	70**	Theory Course/ Engg . Graphics	3 Hours
Two(2) Credits	25	50	Lab Course/Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
One(1) Credit	50	-	Mini Project	-

* Out of 30 CIE, 10 marks are allotted for slip-tests (Three slip tests will be conducted, each of ten marks, and average of best two is considered) and the remaining 20 marks are based on the average of two tests, weightage for each test is 20 marks.

** The question paper will be in two parts, Part-A and Part-B. Part A is compulsory and contains short answer questions covering the entire syllabus, and carries 20 marks. Part-B carries 50 marks and covers all the units of the syllabus (student has to answer five out of seven questions).

Note: A course that has CIE but no SEE as per scheme is treated as PASS/FAIL for which pass marks are **50%** of CIE.

A candidate has earned the credits of a particular course, if he/she secures not less than the minimum marks/ grade as prescribed. Minimum pass marks in the SEE plus CIE shall be **40%** for theory courses/subjects and **50%** for lab courses /Mini Project// Project.

16CSC 40 **SEMINAR**

Instruction	3Hours per week
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:
1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Course Outcomes: On successful of this course **s**tudent will be able to:

1. To study current emerging areas of professional interest.
2. To identify promising new directions of various cutting edge technologies
3. To analyze and make use of appropriate methodologies .
4. To pursue their interest in Computer Science & Engg., through design, research, theoretical and experimental approach.
5. To effectively use modern technologies for presentation before an evaluation committee
6. To acquire skills in preparing detailed report.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2	1	-	-	-	-	-	-	3	3
2	2	2	2	2	2	1	-	-	-		-	-	2	3
3	2	2	1	2	2	-	-	-	-	-	-	-	2	2
4	2	2	2	2	2	-	-	-	-	-	-	-	3	3
5	2	2	2	2	3	1	-	-	3	2	-	-	3	3
6	2	2	2	2	2	1	-	-	2	3	-	-	-	-

Each student is required to:
1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.
4. Seminars are to be scheduled from **3rd week to the last week** of the semester and any change in schedule shall be discouraged.
5. For the award of Sessional marks students are **judged by three (3) faculty** members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
SNo	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

16CSC 41 **PROJECT**

Instruction	6 Hours per week
CIE	50 Marks
SEE	100 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Department Review Committee.

Course Outcomes: By the end of course, students will be able to:

1. Demonstrate a sound technical knowledge of their selected topic
2. Design engineering solutions to complex problems utilizing a systematic approach
3. Conduct investigations by using research-based knowledge and methods to provide valid conclusions
4. Create/select/use modern tools for the modeling, prediction and understanding the limitation of complex engineering solutions
5. Communicate with engineers and the community at large in written and oral forms
6. Demonstrate the knowledge, skills and attitudes of a professional engineer

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	--	--	--	--	--	--	--	--	--	--	--	2	2
2	2	--	3	--	--	--	--	--	--	--	--	--	2	2
3	2	--	--	3	--	--	--	--	--	--	--	--	--	--
4	2	--	--	--	3	--	--	--	--	--	--	--	--	3
5	--	--	--	--	--	--	--	--	--	3	--	--	--	1
6	2	2	--	--	2	2	--	1	3	--	2	2	--	--

Guidelines for the award of marks in CIE: (Max. Marks: 50)

CIE (Continuous Internal Evaluation) Max. Marks: 50

Evaluation by	Max .Marks	luation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Max. Marks: 100

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

16CSE 14 **` (ELECTIVE-VI)**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives: The objectives of this course are

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Course Outcomes: On Successful completion of this course, student will be able to

1. Discuss different types of cybercrimes and analyze legal frameworks to deal with these cybercrimes.
2. Describe Tools used in cybercrimes and laws governing cyberspace.
3. Analyze and resolve cyber security issues.
4. Recognize the importance of digital evidence in prosecution.
5. Analyze the commercial activities in the event of significant information security incidents in the Organization.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	1	3	1	1	1	-	-	2	-	1
2	3	2	2	3	3	2	1	2	2	1	-	2	-	2
3	2	3	1	3	3	3	1	2	3	2	2	3	-	1
4	2	2	1	3	3	3	1	2	3	2	1	2	-	1
5	2	3	2	3	3	2	1	2	3	2	2	3	-	1

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector; **Tools and Methods Used in Cybercrime:** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives**:** Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Sunit Belpre and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, "Incident Response and computer forensics", Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, "Cyber Security and Cyber Laws", Paperback – 2018.
2. Mark F Grady, Fransesco Parisi, "The Law and Economics of Cyber Security", Cambridge university press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

16CSE 15 **OPTIMIZATION TECHNIQUES (ELECTIVE-VI)**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To introduce fundamentals of Operation Research and Linear Programming
2. To impart knowledge on various methods to solve balanced & unbalanced transportation problems
3. To learn the working solutions of Sequencing Problems and Assignment Problems
4. To study the categories of Integer Programming Problems and Linear Programming Approach for Game Theory
5. To obtain familiarity on Construction of Network and obtaining of Critical Path

Course Outcomes: On successful of this course student will be able to:

1. Calculate the optimum values for given objective function by LPP
2. Solve the solution for maximise the profit with minimum cost by Transportation problem.
3. Determine the optimum feasible solution for sequencing the Jobs
4. Solve and analyze problems on Integer programming and other mathematical programming algorithms.
5. Learn how to deal with real world scenarios of Network analysis, Project Management, for their optimal solutions.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	-	-	-	-	1	-	-	2	-	2	-
2	2	2	2	-	-	-	-	1	-	-	2	-	2	-
3	2	2	2	-	-	-	-	-	-	-	2	-	2	-
4	2	2	2	-	-	-	-	-	-	-	-	-	2	-
5	2	2	2	-	-	-	-	2	1	1	-	-	2	-

UNIT - I

Operation Research: Introduction, Models, Areas of Application. Linear Programming (L.P.) - Mathematical Formulation of L.P. problem, Graphical Method, Simplex Method – Concept of slack, surplus & artificial variables, Manual solutions of LPP, Minimization & Maximization Problems, Special Cases – (i) Alternative optima (ii) Unbounded solutions & (iii) Infeasible solutions to be shown graphically & also by simplex method.

UNIT - II

Definition of the transportation model, Balanced / Unbalanced, Minimization / Maximization, Determination of the initial basic feasible solution using (i) North-West Corner Rule (ii) Least cost method & (iii) Vogel's approximation method for balanced & unbalanced transportation problems. Optimality Test & obtaining of optimal solution (Considering per unit transportation cost)

UNIT - III

Assignment model, Assignment Problem Formulation, Hungarian method for optimal solution, Solving unbalanced problem, Traveling salesman problem and assignment problem, Sequencing models, Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines – Processing n Jobs through m Machines.

UNIT - IV

Integer Programming Problem: Introduction, Types of Integer Programming Problems, Gomory's All-IPP Method, All IPP Algorithm, Branch and Bound Technique

Game Theory: Introduction, Game with Pure Strategies, Game with Mixed Strategies, Dominance Property, Graphical Method for 2 X n or m x 2 Games, Linear Programming Approach for Game Theory.

UNIT - V

Construction of Network – Rules & Precautions, C.P.M. & P.E.R.T. Networks, Obtaining of Critical Path, Time estimates for activities, Probability of completion of project, Determination of floats (total, free, independent & interfering)

Text Books:

1. Kanti Swarup, P. K. Gupta, Man Mohan, "Operations Research", Sultan Chand Publications.
2. R. Pannerselvam, "Operations Research", PHI

16CSE 16 NATURAL LANGUAGE PROCESSING (ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To learn the fundamentals of natural language processing.
2. To understand the various Parsing techniques NLP.
3. To understand the role of semantics of sentences and pragmatics and apply the NLP techniques to IR applications.

Course Outcomes: On successful of this course student will be able to:

1. Define the basic concepts of grammars languages and applications of Natural Language processing --
2. Discuss about the language modelling techniques
3. Identify the basic words, parsers and various levels in processing of natural language.-
4. Explain the various semantics discourse and pragmatic levels of NLP
5. Analyze Natural language Generation and apply machine translation.
6. Implement levels of NLP system using the Components or lexical resources to demonstrate Morphology / syntax of a language.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	-	1	-	-	-	-	-	-	-	3		
2	3	2	1	2	3	-	-	-	-	-	-	1	1	3
3	3	2	1	1	-	-	-	-	-	-	-	1	-	-
4	3	3	1	2	-	-	-	-	-	-	-	1	-	-
5	3	2	1	2	2	-	-	-	-	-	-	2	-	-
6	3	3	1	2	-	-	-	-	-	-	-	2	-	-

UNIT - I

Overview and Language Modeling

Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval. **Language Modeling:** Introduction-Various Grammar-based Language Models-Statistical Language Model.

UNIT - II

Word Level and Syntactic Analysis

Word Level Analysis: Introduction Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. **Parsing:** Constituency Parsing - Probabilistic Parsing.

UNIT - III

Semantic Analysis and Discourse Processing

Semantic Analysis: Introduction- Meaning Representation-Lexical Semantics Ambiguity-Word Sense Disambiguation. **Discourse Processing:** Introduction- cohesion-Reference Resolution Discourse Coherence and Structure.

UNIT - IV

Natural Language Generation and Machine Translation

Natural Language Generation: Introduction-Architecture of NLG Systems Generation Tasks and Representations-Application of NLG. Problems in Machine Translation, Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages.

UNIT - V

Applications and Lexical Resources: Information Extraction, Automatic Text Categorization and Text Summarization, Question-Answering System. LEXICAL RESOURCES: Introduction - WordNet- FrameNet – Stemmers - POS Tagger, Research Corpora, NLTK.

Text Books:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

Suggested Reading:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, Prentice Hall, 2nd Edition, 2008.
2. James Allen, Bejamin/cummings, “Natural Language Understanding”, 2nd edition, 1995.

16CSE 17 VIRTUAL REALITIES (ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Provide detailed understanding of the concepts of Virtual Reality and applications
2. Understand geometric modeling and virtual environment
3. Prepare the students to develop Virtual Reality applications

Course Outcomes: On successful of this course student will be able to:

1. Understand the fundamental concepts of Virtual Reality
2. Identify the applications of Virtual Reality
3. Know the virtual hardware and software
4. Familiarize with various VR technologies
5. Design and Develop Virtual Reality based applications

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	-	-	1	-	-	-	-	-	-	-	1	1
2	1	2	2	2	1	-	-	-	-	-	-	-	1	1
3	2	2	2	2	1	-	-	-	-	-	-	-	1	1
4	1	1	1	1	2	-	-	-	-	-	-	-	1	2
5	2	2	3	2	3	1	-	-	-	-	-	-	1	1

UNIT - I

Introduction to Virtual Reality- Introduction, Computer Graphics, real time computer graphics, flight simulation, virtual environment requirement, benefits of virtual reality, historical development of VR, scientific landmark; **3D Computer Graphics:** Introduction, virtual world space, positioning the virtual observer, perspective projection, human vision, stereo perspective projection, 3D clipping, color theory, simple 3D modeling, illumination models, reflection models, shading algorithms, radiosity, Hidden surface removal, realism0stereographic image

UNIT - II

Geometric Modeling: Introduction, 2d to 3D, 3D space curves, 3D boundary representation, **Geometric Transformations:** Introduction, frames of reference, modeling transformations, instances, picking, flying, scaling the VE, collision detection; **Generic VR system**: Introduction, virtual environment, computer environment, VR technology, Model of interaction, VR systems

UNIT - III

Virtual Environment: Introduction, dynamics of numbers, linear and non-linear interpolation, animation of objects, linear and non-linear translation, shape and object in between, free from deformation, particle system, **Physical Simulation:** Introduction, objects falling in a gravitational field, rotarotating wheels, elastic collisions, projectivities, simple pendulum, springs, flight dynamics of an aircraft

UNIT - IV

VR Hardware and Software: Human factors-eys, ear and somatic senses; **VR Hardware**: Introduction, sensor hardware, hed-coupled displays, acoustic hardware, integrated VR system; **VR Software:** Modeling virtual world, physical simulation, VR toolkits, introduction to VRML

UNIT - V

VR Applications: Engineering, Entertainment, Science, Training, **Future:** Virtual environment, modes of interaction

Text Books:

1. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007
2. Anad R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi

Suggested Reading:

1. Adams, "Visualization of Virtual Reality", Tata McGraw Hill, 2000
2. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2006
3. William R Sherman, Alan B Craig, "Understanding Virtual Reality: Interface, Applications and Design", Morgan Kaufman, 2008

Online Resources:

1. www.vresources.org
2. www.vrac.iastate.edu
3. www.w3.org/MarkUp/VRM

16CSE 18 BIOINFORMATICS (ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Understand the basic concepts, search and visualize information.
2. Learn various bioinformatics algorithms.
3. Understand various data mining and pattern matching techniques.

Course Outcomes: On successful of this course student will be able to:

1. Understand the basics concepts of Bioinformatics and its significance in Biological data analysis**.**
2. Represent biological information using various algorithms
3. Apply data mining and pattern matching techniques
4. Choose and apply appropriate statistical methods for solving complex biological problems.
5. Reviewing the various bioinformatics tools and their Applications.
6. Design real-time solutions by using basic principles of biology, Computer Science and mathematics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	2	3	3	3	3	2	2	2	2	1	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	2	2	3	3	3	3	3	2	2	3	3	3
4	3	3	2	3	2	2	2	2	2	2	2	3	3	2
5	3	2	2	3	3	2	2	3	3	2	3	3	2	2
6	2	2	3	3	3	3	3	3	3	3	3	3	2	2

UNIT - I

Introduction to Bio-Linux and Networks: Introduction to networking in Linux, Basic commands in linux-pwd, awk, grep, sed, ls, remote login, ftp, wget, different shells such as c shell, Network basics and tools, File Transfer protocol in Linux, Network File System, Domain Name Services, Networks, Geographical Scope, Communication Models, Transmissions Technology.

UNIT - II

Bio-Basics: Kingdom of life-Bacteria, virus, plant, animal-Central dogma-chromosome-Prokaryotic genes and eukaryotic genes, Gene expression,-Genetic code-Protein synthesis basics, protein structures.

UNIT - III

Pattern matching: Pair-wise sequence alignment, Local versus global alignment, BLAST and its versions, Multiple sequence alignment, Dot Matrix analysis, Substitution matrices, Dynamic Programming, Word methods, Bayesian methods, Multiple sequence alignment, Dynamic Programming, Progressive strategies ,Iterative strategies, Tools, Nucleotide Pattern Matching, Polypeptide pattern matching, Utilities, Sequence Databases protein structure determination- abinito-threading- homology modeling methods.

UNIT IV

Bio-Statistics: Statistical concepts, Imperfect Data, Randomness, Variability, Approximation, Interface Noise, Assumptions, Sampling and Distributions, Hypothesis Testing, Quantifying Randomness, Data Analysis, Tool selection statistics of Alignment, Clustering and Classification.

UNIT V

Biodatabases and Data Mining: Biodatabase- basics of PHP, MySQL or MongoDB, HTML, CSS, java scripting Basics or Wordpress, Data Mining: Methods, Selection and Sampling, Preprocessing and Cleaning, Transformation and Reduction, Data Mining Methods, Evaluation, Visualization, Designing new queries, Pattern Recognition and Discovery, Machine Learning ,Text Mining , Tools.

Text Books:

1. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education, 2015.
2. T.K.Attwood and D.J. Perry Smith, “Introduction to Bio Informatics, Longman Essen, 1999.
3. JinXiong, “Essential Bio Informatics”, Cambridge University Press,2006.

Suggested Readings:

1. Neil C.Jones, PaveA. Pevzner, ”An Introduction to, Bioinformatics Algorithms (Computational Molecular Biology)”, MIT Press 2004.

Online Resources:

1. https://nptel.ac.in/courses/102106065/
2. https://www.ncbi.nlm.nih.gov/

16CSE 19

HUMAN COMPUTER INTERACTION (ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Learn the foundations of Human Computer Interaction.
2. Familiarize with the design technologies for computer interaction.
3. Learn the design strategies, guidelines, models and theories for developing a user friendly interface.

Course Outcomes: On successful of this course student will be able to:
1. Understand the structure of models and theories of human computer interaction.
2. Understand the vision of a computer user.
3. Understand the recognition and remembrance limitations of a computer user.
4. Understand the design rules and design process.
5. Apply the models and theories of human computer interaction to real-time problems

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	-	-	-	-	-	1	-	1		
2	3	1	2	1	1	-	-	-	-	1	-	1		
3	3	1	2	1	1	2	-	-	-	1	-	1		
4	3	1	1	1	1	2	1	-	1	1	-	1		
5	3	1	1	1	1	2	1	-	1	1	-	1		

UNIT - I

Foundations: The human, The computer, The Interaction, Paradigms. Introduction, Our perception is biased, Our vision is optimized to see structure

UNIT - II

We Seek and Use Visual Structure, Our Color Vision is Limited, Our Peripheral Vision is Poor, Reading is Unnatural, Our Attention is Limited; Our Memory is Imperfect, Limits on Attention Shape Our Thought and Action

UNIT - III

Recognition is Easy; Recall is Hard, Problem Solving and Calculation are Hard, Many Factors Affect Learning, Human Decision Making is Rarely Rational

UNIT - IV

Our Hand–Eye Coordination Follows Laws, We Have Time Requirements, Well-known User-Interface Design Rules, Design Process**:** Interaction design basics, HCI in the software process, Design rules

UNIT - V

Models and Theories: Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models, Task analysis, Hypertext, multimedia and the World Wide Web.

Text books:

1. Jeff Johnson, "Designing with the Mind in Mind – Simple Guide to Understanding", 2nd edition, Elsevier Inc., 2010.
2. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, "Human Computer Interaction", 3rd edition, Pearson Education Limited, 2004.

Suggested Reading:

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, "Designing the User Interface", 5th Edition, Pearson Education Limited, 2013.
2. John Haugeland, "Mind Design II", 2nd Edition, Revised and enlarged edition, The MIT Press, 1997.

16CSE 20 **SOCIAL NETWORKING AND ITS IMPACT(ELECTIVE-VII)**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Familiarize the students with social networks and their representation.
2. Understand the impact of social networks on society.
3. Study and Analyze the social network search models.

Course Outcomes: On successful of this course **s**tudent will be able to:

1. Understand a broad range of social networks concepts and theories.
2. Appreciate how network analysis can contribute to increasing knowledge about diverse aspects of society.
3. Analyze social network links and web search.
4. Communicate the analysis results and impact of social networks.
5. Differentiate between centralized and decentralized search models.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	1	1	-	1	1	-	1	1	-
CO2	3	2	1	-	-	-	-	-	-		-	-	1	1
CO3	2	2	2	1	-	1	-	-	-	1	-	-	1	1
CO4	2	2	1	2	1	1	-	-	-	-	-	-	1	1
CO5	3	2	2	1	-	-	-	-	-	1	-	-	1	1

UNIT - I

Introduction: to Social Networks: Introduction to Social Networks, Challenges, Google page rank, Searching on network, link prediction, contagious, marketing on social networks; **Graphs**: Basic definitions, paths and connectivity, distance and breadth first search, network datasets. **Strong and Weak Ties**: Triadic closure, strength of weak Ties, Tie strength and network structure in large-scale data, Tie strength, social media and passive engagement, closure, structured holes and social capital.

UNIT - II

Networks in surrounding contexts: Homophily, selection and social influence, affiliation, tracking link formation in online data, spatial model of segregation. **Positive and negative relationships**: Structural balance, characterizing the structure of balanced networks, applications of structured balance.

UNIT - III

Link analysis and Web search: Searching the web, ranking, link analysis using hubs and authorities, page rank, link analysis in modern web search, applications beyond web.

Cascading behavior in networks: Diffusion in networks, modeling diffusion, cascades and clusters, diffusion, thresholds and role of weak Ties, extensions of cascade model, knowledge, thresholds and collective actions

UNIT - IV

Power Laws and Rich-get-Richer Phenomena: Popularity as a network phenomenon, power laws, rich-get-richer models, unpredictability of rich-get-richer effects, effects of search tools and recommender systems, analysis of rich-get-richer processes. Pseudo core- how to go viral on the web

UNIT - V

Small world phenomenon: Six degrees of separation, structured and randomness, decentralized search, modeling the process of decentralization search, empirical analysis and generalized models, core-peiphery structures and difficulties in decentralized search, analysis of decentralized search.

Text Books:

1. David Easley, Jon Kleinberg, “Networks, Crowds and Markets”, Cambridge Press, 2010 (available for free download).
2. Mathew O Jackson “Social and Economic Networks”, Princeton University, 2010.

Online Resources:

1. https://nptel.ac.in/downloads/106106169/

16CSE 21 BLOCKCHAIN TECHNOLOGY (ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Computer Networks, Network Security

Course Objectives: The main objectives of this course are:
1. Understand the basic concepts and architecture of blockchain
2. Interpret working of Hyperledger Fabric
3. Applications of blockchain in various domains

Course Outcomes: On successful of this course student will be able to:
1. State the basic concepts of blockchain
2. Understand the list of Consensus
3. Demonstrate and Interpret working of Hyperledger Fabric, SDK composer tool
4. Demonstrate the supply chain.
5. Apply to various use cases from different domains

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
2	3	3	2	1	-	-	-	-	-	-	-	-	-	-
3	3	3	1	2	1	-	-	-	-	-	-	-	-	-
4	3	2	1	-	-	-	-	-	-	-	-	-	-	-
5	3	3	1	-	-	-	-	-	-	-	-	-	-	-

UNIT - I

Introduction: History: Digital Money to Distributed Ledgers - Design Primitives: Protocols, Security, Consensus, Permissions, Privacy-: Blockchain Architecture and Design-Basic crypto primitives: Hash, Signature-Hashchain to Blockchain-Basic consensus mechanisms

UNIT - II

Consensus: Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Blockchain consensus protocols**:** Permissioned Blockchains-Design goals-Consensus protocols for Permissioned Blockchains

UNIT - III

Hyperledger Fabric: Decomposing the consensus process-Hyperledger fabric components-Chaincode Design and Implementation: Hyperledger Fabric II:-Beyond Chaincode: fabric SDK and Front End-Hyperledger composer tool

UNIT - IV

Use Case I: Blockchain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital markets-Insurance- **Use case II:** Blockchain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting

UNIT - V

Use Case III: Blockchain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems : Blockchain Cryptography : Privacy and Security on Blockchain

Text Books:
1. Mark Gates, "Blockchain: Ultimate guide to understanding blockchain, bitcoin, cryptocurrencies, smart contracts and the future of money", Wise Fox Publishing and Mark Gates, 2017.
2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer", 2018.
3. ArshdeepBahga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", ArshdeepBahga, Vijay Madisetti publishers 2017.

Suggested Reading:
1. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media, Inc., 2014.
2. Melanie Swa, "Blockchain ",O'Reilly Media, 2014

E-Books :
1. Blockchain Applications- https://www.blockchain-books.com
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
3. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits,2017 - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc18_cs47/preview
2. https://www.udemy.com/blockchain-and-bitcoin-fundamentals/

16MTO 04 QUANTUM COMPUTINGELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are :

1. Translate fluently between the major mathematical representations and its quantum operations.
2. Implement basic quantum algorithms.
3. Explain quantum decoherence in systems for computation.
4. Discuss the physical basis of uniquely quantum phenomena.

Course Outcomes: On successful of this course student will be able to:

1. Explain the working of a Quantum Computing Program, its architecture and program model.
2. Compute basic mathematical operations.
3. Develop quantum logic gate circuits.
4. Develop quantum algorithm.
5. Program quantum algorithm on major toolkits.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	-	1	1	-
2	2	3	-	-	-	-	-	-	-	-	-	1	1	-
3	3	2	-	-	-	-	-	-	-	-	-	1	1	-
4	2	2	-	-	-	-	-	-	-	-	-	1	1	-
5	2	2	-	-	-	-	-	-	-	-	-	1	1	-

UNIT – I

Introduction to Quantum Computing: Motivation for Studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc), Origin of Quantum Computing, Overview of major concepts in Quantum Commuting (Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement).

UNIT – II

Math Foundation for Quantum Computing: Matrix Algebra: Basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen Vectors.

UNIT – III

Building Blocks for Quantum Program: Architecture of a Quantum Computing Platform, Details of q-bit system of information representation (Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from Quantum algorithmic perceptive e.g. Bell State.

UNIT – IV

Quantum Logic gates and Circuits: Quantum Logic gates and Circuit:Pauli, Hadamard, Phase shift, controlled gates, ising, Deutsch, Swap etc.), Programming model for a Quantum Computing program (Steps performed on classical computer, steps performed on Quantum Computer, Moving data between bits and qubits).

UNIT – V

Quantum Algorithms: Basic techniques exploited by quantum algorithms (Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum walks), Major Algorithms (Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm), OSS Toolkits for implementing Quantum program (IBM quantum experience, Microsoft Q, Rigetti PyQuil (QPU/QVM)).

Text Books:

1. Michael A.Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quanturm Computing Explained", Wiley.

16MEO 02 **ROBOTICSELECTIVE-VIII (OE2)**

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. The configuration, work envelop and motion controls and applications
2. The kinematics and dynamics of robots.
3. Robot end effectors and their design.
4. Robot Programming Languages and Programming methods of robot.
5. Various Sensors and drives and their applications in robots

Course Outcomes: On successful of this course **s**tudent will be able to:

1. Equipped with the knowledge of robot anatomy, work volume and robot applications
2. Familiarized with the kinematic motions of robot and robot dynamics
3. Having good knowledge about robot end effectors and their design concepts
4. Equipped with the Programming methods & drives used in robots
5. Equipped with the principles of various Sensors and their applications in robots.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	2	3	3	3	3	1	3	3	2	3	1	1
CO 2	3	3	3	3	3	0	1	0	2	3	1	3	1	1
CO 3	3	3	3	3	3	0	1	0	2	3	1	3	2	2
CO 4	2	3	3	3	3	3	2	1	3	3	2	3	3	2
CO 5	3	3	3	3	3	3	3	1	3	3	2	3	3	2

UNIT-I

Introduction to Robotics: History and evolution of robots, basic configuration, degree of freedom, work envelope, motion control methods. Various applications in industry: material handling, loading & unloading, processing, welding & painting, assembly and inspection. Requirements and Specifications of Robots

UNIT-II

Rigid Motions and Homogeneous Transformations: Rotation matrix, Homogenous transformation matrix, Denavit-Hartenberg convention, Euler angles, RPY representation, Direct and inverse kinematics for industrial robots for position and orientation.

UNIT-III

Velocity Kinematics – The Manipulator Jacobian: Joint, End effector velocity, direct and inverse velocity analysis. **Trajectory Planning**, interpolation, cubic polynomial, linear segments with parabolic blending, static force and moment transformation, solvability, stiffness, singularities.

UNIT-IV

Robot Dynamics: Lagrangian formulation, link inertia tensor and manipulator inertia tensor. **Newton**-Euler formulation for RR & RP manipulators. **Control**: Individual joint, computed torque.

UNIT-V

End Effectors: Position and velocity measurement, **Sensors**: Proximity and range, tactile, force and torque, Drives for Robots: Electrical, Hydraulic and Pneumatic. **Robot Vision**: Introduction to technique, image acquisition and processing, introduction to robot programming languages.

Text Books:

1. Spong and Vidyasagar, "Robot Dynamics and Control", John Wile and Sons, 1990
2. R.K. Mittal, I.J. Nagrath, "Robotics and control", Tata Mcgraw-Hill Publishing Company Ltd. 2003
3. Groover, "Industrial Robotics", Mcgraw-Hill Publishing Company Ltd. 2003

Suggested Reading:

1. Asada and Slotine, "Robot analysis and Intelligence", Wiley Interscience, 1986
2. K.S. Fu Gon ZalezRC., lEEc.S.G., "Robotics, Control Sensing Vision and Intelligence", McGraw Hill, Int. Ed., 1987
3. Richard S. Paul, "Robot Manipulators: Mathematics, Programming, and Control", MIT Press

16MEO 04 INTELLECTUAL PROPERTY RIGHTS ELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

Course Outcomes: On successful of this course student will be able to:
1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	3	-	1	-	-	-	2	-	-	-
2	-	-	-	-	3	-	1	-	-	-	2	-	-	-
3	-	-	-	-	3	-	1	-	-	-	2	-	-	-
4	-	-	-	-	3	-	1	-	-	-	2	-	-	-
5	-	-	-	-	3	-	1	-	-	-	2	-	-	-

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT, **Patents:** Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT-III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection. **Unfair Competition:** What is unfair competition. Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D’ Souza, “Indian Patents Law – Legal & Business Implications”, Macmillan India ltd , 2006
2. B. L.Wadehra; “Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications”, Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan, “Law of Copyright and Industrial Designs”, Eastern law House, Delhi 2010

Suggested Reading:

1. W.R1 Cronish, “Intellectual Property; Patents, copyright, Trad and Allied rights”, Sweet & Maxwell, 1993.
2. Narayanan, “Intellectual Property Law”, Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, “A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs”, 4/e, Sweet, Maxwell.

16PYO 01 HISTORY OF SCIENCE AND TECHNOLOGY ELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Enable students to understand science as a socio-cultural product in specific socio-historical contexts.
2. Expose students to philosophical, historical and sociological perspectives to look at science as a practice deeply embedded in culture and society.
3. Inculcate the scientific culture and ethics in the development of technologies.

Course Outcomes: On successful of this course student will be able to:
1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rig our and a sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	1	2	2	1	1	2	1	2		
2	3	1	2	1	2	2	2	1	2	2	2	2		
3	2	2	1	1	1	1	1	1	1	2	1	2	1	1
4	3	2	2	2	2	2	2	1	1	2	1	2	1	1
5	3	2	2	2	2	1	2	2	1	2	1	2	1	1

UNIT - I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization, Major advances. **Science in Antiquity (600 BC - 529 AD):** Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT - II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances. **The Renaissance and the Scientific Revolution (1453 AD – 1659 AD):** Renaissance, Scientific Revolution, Technology, Major advances.

UNIT - III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances. **The Industrial Revolution (1735 AD – 1819 AD):** Industrial Revolution, Rise of the engineer, Major Advances.

UNIT - IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances. **Rise of Modern Science and Technology (1895 AD – 1945 AD):** The growth of 20thcentury science, New philosophies, Quantum reality, Energy sources, Electricity: a revolution in Technology, Major advances.

UNIT - V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances. **The Information Age (1973 AD – 2015 AD):** Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances

Text Books:
1. Bryan and Alexander Hellemans, "The History of Science and Technology", Houghton Mifflin Company, 2004.
2. JD Bernal, "Science in History", 4 volumes, Kindle Edition.

Suggested Readings:
1. "The 100 Most Influential Scientists of All Time", Edited by Kara Rogers, Britannica Educational Publishing, 2010

2. Alberto Hernandez, “A Visual History of Science and Technology”, The Rosen Publishing Group, 2016

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(CBCS CURRICULUM)

OPEN ELECTIVE FOR OTHER PROGRAMME

S.NO.	SUBJECT CODE	SUBJECT NAME
1	16CSO 01	Python for Bioinformatics
2	16CSO 02	JAVA Programming and Bio-Java
3	16CSO 03	IOT and Applications
4	16CSO 04	Basics of Data Science using R
5	16CSO 05	Fundamentals of Virtual Reality
6	16CSO 06	Fundamentals of DBMS
7	16CSO 07	Basics of Cyber Security
8	16CSO 08	Open Source Technologies
9	16CSO 09	Basics of Artificial Intelligence
10	16CSO 10	Machine Learning Using Python

16CSO 01

PYTHON FOR BIOINFORMATICS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Introduce Python with reference to bioinformatics.
2. Understanding of various algorithms useful for biological sequences.
3. Identification Python modules useful to analyze gene and Biological sequences

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics of Python Programming.
2. Develop applications using Python to solve problems.
3. Identify and use Python modules related to Biology.
4. Analyze biological and gene sequences using Python.
5. Understand advanced analysis techniques.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	1	-	-	-	-	-	-	-	1	1	1
2	2	3	2	2	1	-	-	-	-	-	-	1	2	2
3	2	2	2	1	2	1	-	-	-	-	-	1	2	1
4	1	2	2	2	2	2	1	-	-	-	-	1	2	1
5	-	3	2	1	1	1	-	-	-	-	-	-	1	2

UNIT - I

Introduction to Python: Basics of Python, Python IDEs, Running Python programs, types and operations, Functions, modules, classes, Exceptions.

UNIT - II

Object-Oriented Programming, Modules: Object Oriented Programming, Threads, process, synchronization, databases and persistence, NumPy, SciPy, Image manipulation, Akando and Dancer modules.

UNIT - III

Biological Sequence Analysis: Biopython: Parsing DNA data files, Sequence Analysis, Dynamic Programming, Hidden Markov Model, Genetic Algorithms, Multiple Sequence Alignment, gapped alignment.

UNIT - IV

Advanced Analysis Techniques: Trees, Text Mining, Clustering, Self-Organizing Map, Principal Component Analysis and Numerical Sequence Alignment.

UNIT - V

Expression Analysis: Gene expression array analysis, Spot finding and Measurement, Spreadsheet Arrays and Data Displays, Applications with expression Alignment.

Text Books:
1. Jason Kinser, “Python for Bioinformatics”, Jones & Bartlett Publishers, 2nd Edition, 2013.
2. Reema Thareja “Python Programming”, Oxford Press, 2017.

Suggested Reading:
1. Mark Lutz, “Learning Python”, 3rd edition, O’Reilly, 2007.
2. Alex Martelli, David Ascher, “Python cookbook”, O’Reilly, 2002.

Online Resources:
1. http://www.biopython.org

16CSO 02

` JAVA PROGRAMMING AND BIO-JAVA
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basics of any programming language.

Course Objectives: The main objectives of this course are:

1. To introduce the concepts of Object-Oriented programming.
2. Prepare the students to develop solutions using OOPs concepts.
3. Design and develop Biotechnology related solutions using Java and Java class libraries.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand fundamental concepts in object-oriented programming.
2. Design and develop computer based solutions to solve real world problems.
3. Handle file I/O and exceptions.
4. Create Windows, Containers, GUI components in Java.
5. Create GUI-based applications related to Biotechnology problems.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	-	-	1	1	-	-	-	-	1	1	-
2	2	2	3	2	1	1	1	-	-	-	-	1	2	1
3	2	2	2	1	2	-	-	-	-	-	-	1	1	1
4	2	2	1	1	1	-	-	-	-	-	-	1	1	1
5	2	2	3	1	2	-	-	-	-	-	-	2	2	2

UNIT - I

Java Essentials: Features of Java, OOPs concepts in Java, Elements of java program, Variables, and Literals, Data Types, variables and arrays, Operators, arrays Control structures: if, if-else, nested if, if-else-if, switch, while, do-while, for, break and continue statements.

UNIT - II

Classes and Objects: Introduction to classes and methods, typecasting, access specifiers and modifiers, modifiers, passing arguments, Constructors. Inheritance: Basics of inheritance, types of inheritance, polymorphism.

UNIT - III

Interfaces and Packages: Basics of interfaces, Packages, Exception handling: Types of exceptions and Errors, exception handling, Multithreading concepts. Files and I/O Streams: File Class, Streams, Byte Streams.

UNIT - IV

AWT and Applets: Applets, GUI, Window class hierarchy, Dialog Boxes,, Layout managers, Swing Component Classes, Event-Handling, AWT Graphics classes and Swing Controls.

UNIT - V

StrBio Lib: Molecular Biology Classes, Interfaces to Bioinformatics tools and Databases, General purpose tools, applications. Writing simple Java programs for Biotechnology related problems.

Text Books:

1. Sagayaraj, Denis, KArthik and Gajalaxmi, "Java Programming", for Core and Adanced Learners", University Press, Pvt. Ltd, 2018.
2. Johan-Marc Chandonia, "StrBioLib: a Java Library for Development of Custom Computations Structural Biology Applications", BIO-INFO ALPPLICATIONS NOTE, Vol. 23, No. 15,2007, PP2018-2020 (https:// academic.oup.com/bioinformatics/article-abstract/23/15/2018/203542)

Suggested Reading:

1. Herbert Schildt, " The complete reference Java 2", TMH
2. Internet World 60 minute Java by Ed Tittel

Online Resources:

1. https://www.tutorialspoint.com/java/index.htm

16CSO 03

IOT AND APPLICATIONS
(Open Elective)

Instruction 3 Hours per week
Duration of End Examination 3 Hours
Semester End Examination 70 Marks
CIE 30 Marks
Credits 3

Pre-requisites: Programming Basics.

Course Objectives: The main objectives of this course are:
1. Impart necessary and practical knowledge of components in Internet of Things.
2. Understand working of IoT Systems.
3. Develop skills required to build IoT based systems.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand Internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Remotely monitor data and control devices.
4. Develop real time IoT based projects.
5. Advance towards research based IoT.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	-	-	-	-	-	-	-	-	1	1	1
2	3	2	2	-	1	-	-	-	1	-	1	1	1	1
3	3	3	2	1	1	-	-	-	-	-	1	1	1	1
4	2	2	2	-	1		-	-	1	-	1	1	1	1
5	2	2	1	2	-	-	-	-	-	-	-	1	1	1

UNIT – I

Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators and Types of Actuators.

UNIT – II

Basics of Networking: Functional Components of IoT, IoT interdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

UNIT – III

IoT Hardware Components: Computing (Arduino/Raspberry Pi), Communication, Sensors, Actuators, I/O interfaces, Programming API's (for Arduino/ Raspberry Pi).

UNIT – IV

IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, Authorization of devices

UNIT – V

IoT Systems and Applications: Smart Lighting, Weather Monitoring System, Weather Reporting Bot, Forest Fire Detection, Alcohol Detection System, Smart Parking Environment., Drip-irrigation, Biological water treatment system, Work flow Automation in Industries, Smart Intrusion Detection System, monitoring space risks and hazardous conditions in industrial regions like underground tanks, trap door margins.

Text Books:

1. Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, “Internet of Things:Architecture and Design”, McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, “Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers, Series in Communications, 2013.

Online Resources / Weblinks / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, “Internet of Things in Industries: A Survey “, IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. Gotovtsev, Pavel M., and Andrey V. Dyakov. "Biotechnology and Internet of Things for green smart city application." 2016 IEEE 3rd World Forum on Internet of Things (WF-IoT). IEEE, 2016.
3. Yanjing, Sun, et al. "Research and design of agriculture informatization system based on IOT." Journal of Computer Research and Development 48 (2011): 316-331.
4. Somov, Andrey, et al. "Bacteria to power the smart sensor applications: Biofuel cell for low-power IoT devices." 2018 IEEE 4th World Forum on Internet of Things (WF-IoT). IEEE, 2018.
5. Han, Shuqing, et al. "Analysis of the frontier technology of agricultural IoT and its predication research." IOP Conference Series: Materials Science and Engineering. Vol. 231. No. 1. IOP Publishing, 2017.

16CSO 04

BASICS OF DATA SCIENCE USING R
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Probability and Statistics, basics of programming languages.

Course Objectives: The main objectives of this course are:
1. Understand R programming language.
2. Explore the programming skills needed to use R tool for statistical analysis of Biological data.
3. Analyze biological data.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics of R, various statistical measures, algorithms useful for data analysis.
2. Explore the programming skills needed to use R tool for biological data.
3. Analyze biological data using R tool.
4. Apply classification and clustering algorithms to biological data.
5. Identify and work with the technologies and resources related to bioinformatics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	3	2	-	-	-	1	1	2	2	-
2	3	3	2	3	2	2	-	-	1	1	2	2	2	1
3	3	3	2	2	2	2	-	-	1	2	3	2	2	1
4	3	3	3	2	3	2	-	-	1	3	2	3	2	-
5	3	3	2	2	2	2	-	-	1	2	2	2	2	1

UNIT - I
Basics of R: Introduction, R features, setting up and exploring R environment, loading packages, types of data objects in R, working with R data objects, Controlling work space, importing files. **Programming with R:** Variables and assignment, operators, control structures, Functions-built-in, writing own functions, package creation.

UNIT - II
Data Analysis and Graphics: Data summary functions in R, Graphics technology in R, saving graphics, additional graphics packages. **Bayesian Data Analysis**: Need of Bayesian approach, Application of Bayes rule, Priors, Likelyhood functions, evaluating the posterior, Applications of Bayesial Statistics in Bioinformatics. **Stochastic Modeling**: Stochastic process and Markov Processes, Classification of Stochastic processes, modeling a DNA sequence with Markov Chain, Characteristics of Markov Chain.

UNIT - III
MCMC using Brugs: ABO blood type example. Gibbs sampling. **Statistical Inference:** Sampling distributions, Parameter estimation, interval estimation, bootstrapping, R packages for bootstrapping. **Hypothesis Testing**: Package ctest, Binomial test, comparing variances, Wilcoxon tests, Chi-Square test, Fisher's Exact tests, Likelihood Ratio tests.

UNIT - IV
ANOVA and Regression: ANOVA table, perforating ANOVA using R, graphical analysis of ANOVA comparison, Regression: Correlations, linear regression model, fitting and testing of regression model, generalization of the model. **Working with Multivariate Data:** Multivariate data, sample statistics, display of multivariate data, outliers and principal components. Classification of discriminate analysis- classification with two population and more than two populations, cross validation classification trees.

UNIT - V

Clustering methods: measures of dissimilarities, K-means clustering, K-Medoid clustering, Hierarchical clustering-Agglomerate and divisive. **R Packages:** Bio-conductor and Seqin R.

Data Technologies: R for Data manipulation, example, Database technologies, Bioinformatics resources on the WWW.

Text Books:

1. Kim Seefeld, Ernest Linder, “Statistics using R with Biological examples”, 2007 (https://cran.r-project.org/doc/contrib/Seefeld_StatsRBio.pdf).
2. Robert Gentleman, “R Programming for Bioinformatics”, 1st Edition, CRC Press, 2008.

Suggested Reading:

1. Arvil Cohhlan “A Little Book of R for Bioinformatics”, Release 1.0, CC ver 3.0

Online Resources:

1. https://epdf.tips/r-programming-for-bioinformatics.html
2. https://epdf.tips/r-programming-for-bioinformatics.htmlhttps://www.cyclismo.org/tutorial/R/objectOriented.html
3. https://www.w3schools.in/r/object-oriented/

16CSO 05

FUNDAMENTALS OF VIRTUAL REALITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To introduce hardware and software components of virtual reality.
2. To provide knowledge about geometry of virtual worlds.
3. To understand visual physiology, perception and audio in VR.
4. To study the applications of VR in various domains like military and robotics.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Define Virtual Reality and acquire knowledge of virtual worlds.
2. Apply modeling techniques to model real world scenarios.
3. Study human factors for developing interfaces.
4. Evaluate virtual reality systems.
5. Address the issues and challenges in virtual reality.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	-	-	-	-	-	-	-	-	-	1	1	1
2	2	2	2	2	2	1	-	-	-	-	-	-	1	1
3	1	1	1	2	2	2	1	-	-	-	-	1	1	1
4	2	2	2	2	2	-	-	-	-	--	-	-	1	1
5	1	1	1	1	1	2	2	2	-	-	-	1	1	1

UNIT - I

Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. **Input Devices:** Trackers, Navigation and Gesture Interfaces: Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. **Output Devices:** Graphics displays, sound displays and haptic feedback.

UNIT - II

Geometry of Virtual Worlds: Geometric modeling, Transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, Axis-angle representations, Quaternions, Converting and multiplying rotations, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Canonical view transform , Viewport transform.

UNIT - III

Light and Optics : Three interpretations of light, Refraction, Simple lenses, Diopters, Imaging properties of lenses, Lens aberrations, Optical system of eyes. **Visual Physiology:** Photoreceptors, Sufficient resolution for VR, Light intensity, Eye movements, Eye movement issues for VR, Neuroscience of vision, **Visual Perception:** Depth perception, Motion perception, Frame rates and displays.

UNIT - IV

Tracking Systems : Overview, Orientation tracking, Tilt drift correction, Yaw drift correction, Tracking with a camera, Perspective n-point problem, Filtering, Lighthouse approach, **Visual Rendering:** Overview, Shading models, Rasterization, Pixel shading, VR-specific problems, Distortion shading, Post-rendering image warp.

UNIT – V

Audio: Physics and physiology, Auditory perception, Auditory localization, Rendering, Spatialization and display, Combining other senses, **Interfaces:** overview, Locomotion, Manipulation, System control, Social interaction, Evaluation of VR Systems, **Applications:** Medical, Military, Robotics, issues and challenges in virtual reality.

Text Books:
1. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007
2. Anad R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

Suggested Reading:
1. George Mather, "Foundations of Sensation and Perception:Psychology", Press; 2 edition, 2009.
2. Peter Shirley, Michael Ashikhmin, and Steve Marschner, "Fundamentals of Computer Graphics", A K Peters/CRC Press; 3 edition, 2009.

Online Resources:
1. http://msl.cs.uiuc.edu/vr/

16CSO 06

FUNDAMENTALS OF DBMS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: File Structures.

Course Objectives: The main objectives of this course are:
1. To learn data models, conceptualize and depict a database system using E-R diagram.
2. To understand the internal storage structures in a physical DB design.
3. To know the fundamental concepts of transaction processing techniques.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Understand the find fundamental components of the DBMS.
2. Design the database schema and develop E-R model.
3. Devise queries using relational algebra and SQL.
4. Apply normalization techniques and solve problems using various Indexing techniques.
5. Understand transaction processing, Concurrency control and recovery techniques.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	1	-	-	--	-	-	-	-	-	1	2
2	3	3	3	1	-	-	-	-	-	-	-	-	1	2
3	2	2	3	1	-	-	-	-	-	--	-	-	1	2
4	1	3	2	2	-	-	-	-	-	-	-	-	1	2
5	3	1	2	1	-	2	-	1	-	-	-	-	1	2

UNIT - I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures. **Database Design and E-R Model:** Basic concepts, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations. **Structured Query Language:** Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT - III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT - IV

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files. **Transaction Management:** Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT - V

Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery, **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, "An Introduction to Database Systems", Eight Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, Johnnes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, "Fundamentals of Database Systems", Fourth Edition, Pearson Education,2006.

16CSO 07

BASICS OF CYBER SECURITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives: The main objectives of this course are:

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Course Outcomes: On Successful completion of this course, student will be able to

1. Discuss different types of cybercrimes and analyze legal frameworks to deal with these cybercrimes.
2. Describe Tools used in cybercrimes and laws governing cyberspace.
3. Analyze and resolve cyber security issues.
4. Recognize the importance of digital evidence in prosecution.
5. Analyze the commercial activities in the event of significant information security incidents in the Organization.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	1	3	1	1	1	-	-	2	-	1
2	3	2	2	3	3	2	1	2	2	1	-	2	-	2
3	2	3	1	3	3	3	1	2	3	2	2	3	-	1
4	2	2	1	3	3	3	1	2	3	2	1	2	-	1
5	2	3	2	3	3	2	1	2	3	2	2	3	-	1

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector.

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives**:** Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Sunit Belpre and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, Incident Response and computer forensics, Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, “Cyber Security and Cyber Laws”, Paperback – 2018.
2. Mark F Grady, Fransesco Parisi, “The Law and Economics of Cyber Security”, Cambridge university press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

16CSO 08

OPEN SOURCE TECHNOLOGIES
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Familiarity with Open Source Technologies.
2. Examples of OSS Projects, Advantages of Open Source.
3. Understand the principles, methodologies of OSS.
4. Understand the policies, licensing procedures and ethics of OSS.

Course Outcomes: On Successful completion of this course, student will be able to
1. Differentiate between Open Source and Proprietary software and Licensing.
2. Recognize the applications, benefits and features of Open Source Technologies.
3. Understand and demonstrate Version Control System along with its commands.
4. Gain knowledge to start, manage open source projects.
5. Understand and practice the Open Source Ethics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	2	2	2	-	-	-	2	1	1	1	3
2	2	2	3	3	2	2	1	1	1	1	2	2	1	3
3	3	3	3	3	3	3	1	-	2	2	3	1	2	3
4	3	3	3	2	3	3	2	2	2	3	2	3	1	3
5	3	3	2	2	2	2	2	3	1	2	2	2	1	3

UNIT – I
Introduction to Open Source: Open Source, need of Open Source, Open Source Principles, Open Source Standards Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Software Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT – II
Fault Tolerant Design: **Principles and Open Source Methodology**- History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copyleft, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT – III
Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, Libre Office.

UNIT – IV
Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media, What Is A License, How to create your own Licenses. Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT – V
Open Source Ethics- Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:

1. Kailash Vadera, Bjhavesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press.

Suggested Reading:

1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, "Perspectives on Free and Open Source Software", MIT press.

16CSO 09

BASICS OF ARTIFICIAL INTELLIGENCE
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basic Mathematics.

Course Objectives: The main objectives of this course are:

1. Provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Differentiate between a rudimentary Problem and an AI problem, it's Characteristics and problem-solving Techniques.
2. Compare and contrast the various knowledge representation schemes of AI.
3. Understand and analyze the various reasoning and planning techniques involved in solving AI problems.
4. Understand the different learning techniques.
5. Apply the AI techniques to solve the real-world problems.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	1	-	-	-	-	-	-	-	-	2	1
2	3	2	2	1		-	-	-	-	-		-	-	2
3	3	2	2	2	-	-	-	-	-	-	-	-	-	-
4	3	2	3	1	-	-	-	-	-	-	-	1	-	-
5	3	3	2	2	1	-	-	-	--	-	-	2	-	-

UNIT - I

Introduction: Definition, history, applications. **Problem Solving:** AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate–and–test, Hill Climbing, Constraint Satisfaction.

UNIT - II

Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification. **Knowledge Representation (Structured):** Declarative representation, Semantic nets, procedural representation, frames.

UNIT - III

Reasoning: Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory. **Planning:** Components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT - IV

Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: Decision tree. **Intelligent Agents:** Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - V

Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition. **Perception and Action:** Real Time Search, Vision, Speech Recognition, ACTION: Navigation, Manipulation, Robot architectures.

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, "Artificial Intelligence", 3rd Edition, 2008
2. Russell Norvig, "Artificial Intelligence-Modern Approach", 3rd edition, 2010.

Suggested Reading:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2012.
2. Nelson M. Mattos, "An Approach to Knowledge Base Management", Springer Berlin Heidelberg, 1991.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

16CSO 10

MACHINE LEARNING USING PYTHON
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Get an idea of Machine Learning algorithms to solve real world problems.
2. Study various machine learning algorithms.
3. Analyze data using machine learning techniques.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics concepts of Machine Learning and Python.
2. Apply feature engineering techniques and visualization tools to the data.
3. Analyze the various types of data by using python based machine learning techniques.
4. Identify and evaluate various recommender systems.
5. Design solutions to real world problems using deep learning algorithms.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	1	-	-	1	1	1	-	1	2	1	2
2	2	1	1	-	1	1	1	1	1	1	-	1	2	1	2
3	2	3	1	1	2	-	-	1	2	2	1	2	2	2	2
4	2	2	1	1	2	-	-	1	1	1	1	2	2	2	2
5	2	2	2	1	2	1	1	2	2	2	1	2	3	2	3

UNIT - I

Introduction to Machine Learning: Introduction, Machine Learning process. **Introduction to Python**: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT - II

Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python. **Data Visualization:** Various charts, histograms, plots.

UNIT - III

Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression. **Classification:** Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes.

UNIT - IV

Unsupervised Learning: Clustering, K-Means clustering, Hierarchical clustering. **Text Analysis:** Basic text analysis with Python, regular expressions, NLP, text classification. **Time Series Analysis**: Date and time handling, window functions, correlation, time series forecasting.

UNIT - V

Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework. **Recommender System:** Recommendation engines, collaborative filtering.

Text Books:
1. Abhishek Vijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018
2. Tom Mitchel "Machine Learning", Tata McGraWHill, 2017
3. Reema Thareja "Python Programming", Oxford Press, 2017.

Suggested Reading:
1. Yuxi Liu, "Python Machine Learning by Example", 2nd Edition, PACT, 2017

Online Resources:
1. https://www.guru99.com/machine-learning-tutorial.html
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

SCHEME OF INSTRUCTION AND SYLLABI (R-20)

OF

B.E. I & II SEMESTERS

IN

COMPUTER SCIENCE & ENGINEERING

(For the batch admitted in 2020-21)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)
Affiliated to Osmania University
Kokapet Village, Gandipet Mandal, Hyderabad– 500 075. Telangana
E-Mail: principal@cbit.ac.in; Website: www.cbit.ac.in; Phone Nos.: 040-24193276 / 277 / 279

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

INSTITUTE VISION AND MISSION:

Vision: To be a Centre of Excellence in Technical Education and Research

Mission: To address the emerging needs through quality technical education and advanced research

DEPARTMENT VISION AND MISSION:

Vision: To be in the frontiers of Computer Science and Engineering with academic excellence and Research

Mission: The mission of Computer Science and Engineering Department is to:

1. Educate students with the best practices of Computer Science by integrating the latest research into the curriculum
2. Develop professionals with sound knowledge in theory and practice of Computer Science and Engineering
3. Facilitate the development of academia-industry collaboration and societal outreach programs
4. Prepare students for full and ethical participation in a diverse society and encourage lifelong learning

PROGRAM EDUCATION OBJECTIVES (PEOs): After the completion of the program, our:

1. Graduates will apply their knowledge and skills to succeed in their careers and/or obtain advanced degrees, provide solutions as entrepreneurs
2. Graduates will creatively solve problems, communicate effectively, and successfully function in multi-disciplinary teams with superior work ethics and values
3. Graduates will apply principles and practices of Computer Science, mathematics and Science to successfully complete hardware and/or software-related engineering projects to meet customer business objectives and/or productively engage in research

PROGRAM SPECIFIC OUTCOMES (PSOs): At the end of the program

1. Graduates will acquire the practical competency in Computer Science and Engineering through emerging technologies and open-source platforms related to the domains
2. Graduates will design and develop innovative products by applying principles of computer science and engineering
3. Graduates will be able to successfully pursue higher education in reputed institutions and provide solutions as entrepreneurs.
4. Graduates will be able to work in multidisciplinary teams for career growth by exhibiting work ethics and values

ABOUT THE DEPARTMENT:

Department of CSE was established in the year 1985 with an intake of 20 students in UG program, gradually increased to 30 in 1991, 40 in 1993, 60 in 1994, 120 in 2000, 180 in 2013.Currently the department offers three UG programs BE (CSE), BE CSE (AI& ML), BE CSE (Internet of Things & Cyber Security including Block Chain Technology) with an intake of 300. M.Tech. CSE was started in the year 2002 with an intake of 18 and increased to 36 in 2011. The intellectual ambiance in CSE Department is conducive to the holistic development of the students.

BE-CSE program was first accredited by the NBA (AICTE) during 1998 with 'A' grade for 3 years , and further accredited during 2004, 2008, 2013 and 2017 consecutively. CSE department is a recognized Research center under Osmania University. CSE Faculty and students as part of their scholarly activities have published patents. Further both faculty and students have research publications in journals of international and national repute. In addition to the normal duties, faculty and Students continuously involve themselves in research and development activities. AICTE, UGC have funded research projects. Skill and Personality Development Centre and PRERANA centres are established with funds received through AICTE.

Department of CSE has centers of excellence in Internet of Things, Artificial Intelligence/Machine Learning, Cyber Security, Association for Artificial Intelligence in HealthCare. Department is also having MoU's with MSME, Robotic Process Automation, Kernel Sphere Technologies, Telangana State Council of Science and Technology and Data Security Council of India.

Department has committed well qualified and professionally active staff. Most of them are pursuing Ph.D. in the emerging areas like AI, ML, Cyber Security, Data Science, Data Mining and Block Chain .

Department is professionally active in conducting workshops and certifications with Microsoft, IBM, Oracle, SAP, Pega . Various activities are also conducted in collaboration with professional bodies like CSI, ISTE along with student branches of IEEE and CSI.

Department encourages the use of open source software and has vibrant technical clubs: CBIT Open Source (COSC) Club and CBIT Information Security Club (CISC). Through these clubs students have participated in various international and national Hackathons and bagged several prizes. Consecutively for the past three years CSE students have won first prize in Smart India Hackathon (SIH).

Students have participated in large numbers and won many worthy prizes in national and international coding competitions. They also presented papers in conferences and attended seminars, bootcamps and workshops.

CSE has maintained an excellent placement record by providing its students with ample opportunities to pursue their career goals. Leading companies that visited the campus for placements include Microsoft, JP Morgan, Accolite, NCR, Oracle, TCS, Infosys, Deloitte, D.E.Shaw, Sales Force, Service Now, Modak, etc., with CTC going well beyond 24 LPA. The number of students who are doing internship is gradually increasing year by year.

During 2017-18, 204 CSE students secured 287 job offers. In 2018-19, the offers increased to 291 for 214 students, further 311job offers for 224 students during 2019-20. The salary trend in CSE has improved over the years with an average salary being 7.1 LPA. The highest salary offered in Placement 2020 is 41.6 LPA. Microsoft offered the highest CTC of 41.60 LPA. Six students have got their placement in Microsoft with the Super Dream Offer. From the batch of 211 students, 65 students secured multiple job offers out of which 23 students secured three offers.

ABOUT B.E. (CSE) PROGRAM:

In order to understand the needs and problems in the real world, one must have the foundational aspects of computing, science and engineering skills to create, invent, generate, contrive, devise ideas with their ingenium.

B.E Computer Science and Engineering program begins with basic sciences and mathematics, which gives theoretical foundational knowledge for computing .Students acquire knowledge in computing and application domains at different levels of abstraction which includes hardware and software related courses, efficient models, techniques, algorithms for handling data. Students learns modern tools and methodologies which can be applied for the real world problems.

The first half of BE (CSE) program focuses on building the foundations and the second half is for developing the skills and knowledge of the students in various computing and application domains of their choice.

This program is best suited for students seeking to build world-class expertise in Computer Sciences or to undertake advanced studies for research careers or to take up Entrepreneurship.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of I Semester of B.E. – Computer Science & Engineering as per AICTE Model Curriculum 2020-21

B.E. - COMPUTER SCIENCE & ENGINEERING

SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20MT C01	Linear Algebra & Calculus	3	-	-	3	40	60	3
2	20EG C01	English	2	-	-	3	40	60	2
3	20PY C01	Optics and Semiconductor Physics	3	-	-	3	40	60	3
4	20CS C01	Programming for Problem Solving	3	-	-	3	40	60	3
PRACTICAL									
5	20MT C02	Linear Algebra & Calculus Lab	-	-	2	3	50	50	1
6	20EG C02	English lab	-	-	2	3	50	50	1
7	20PY C03	Optics and Semiconductor Physics Lab	-	-	4	3	50	50	2
8	20CS C02	Programming for problem Solving Lab	-	-	4	3	50	50	2
9	20ME C01	CAD AND DRAFTING	-	1	3	3	50	50	2.5
10	20MB C02	Community Engagement	30 field + 2P/W			-	50	-	1.5
TOTAL			**11**	**1**	**15**	**-**	**460**	**490**	**21**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

20MT C01

LINEAR ALGEBRA & CALCULUS
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To explain the solutions of system of linear equations by Matrix Methods.
2. To discuss the convergence and divergence of the Series.
3. To explain the Partial Derivatives and the extreme values of functions of two variables
4. To discuss Physical interpretations on Scalars and vector functions
5. To discuss vector line, surface and volume integrals.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the Matrix Methods to solve the system of linear equations
2. Test the convergence and divergence of the infinite Series.
3. Determine the extreme values of functions of two variables.
4. Apply the vector differential operator to scalar and vector functions
5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.

UNIT-I

Matrices: Rank of a matrix, Echelon form, consistency of linear System of equations, Linear dependence of vectors, Eigen values, Eigenvectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-II

Infinite Series: Definition of Convergence of sequence and series. Series of positive terms –Necessary condition for convergence, Comparison tests, limit form comparison test, D'Alembert's Ratio test, Raabe's test, Cauchy's root test, alternating series, Leibnitz's rule, absolutely and conditionally convergence.

UNIT-III

Partial Differentiation and Its Applications : Functions of two or more variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions, Jacobians, Taylor's expansion of functions of two variables, Maxima and minima of functions of two variables.

UNIT-IV

Vector Differential Calculus: Scalar and vector point functions, vector operator Del, Gradient, Directional derivative, Divergence, Curl, Del applied twice to point functions, Del applied to product of point functions (vector identities). Applications: Irrotational fields and Solenoidal fields.

UNIT-V

Vector Integral Calculus: Line integral, Surface integral and Volume integral. Green's theorem in the plane, verifications of Stroke's theorem (without proof) and Gauss's divergence theorem (without proof).

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition,2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw- Hill, New Delhi,2 008.
2. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

with effect from the Academic Year 2020-21

20 EG C01

ENGLISH

(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Course Objectives: This course will introduce the students:

1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

Course Outcomes: After successful completion of the course the students will be able to:

1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques

UNIT-I Understanding Communication in English:
Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.
Vocabulary &Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT-II Developing Writing Skills I:
Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.
Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT-III Developing Writing Skills II:
Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response
Vocabulary and Grammar: Subject-verb agreement.
Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

UNIT-IV Developing Writing Skills III:
Report writing – Importance, structure, elements of style of formal reports ; Writing a formal report.
Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

UNIT-V Developing Reading Skills:
The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar: Words often confused; Use of standard abbreviations.

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP. 1995.

Suggested Readings:

1. Wood F.T, Remedial English Grammar,Macmillan,2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, Communication Skills. Oxford University Press, 2011.

Code: 20PY C01

OPTICS AND SEMICONDUCTOR PHYSICS

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	3 L / week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of the course is to make the student

1. Understand the fundamentals of wave nature of light
2. Acquire knowledge of lasers, holography and fiber optics
3. Familiarize with quantum mechanics
4. Learn the fundamental concepts of solids

Course Outcomes: At the end of the course, the student will be able to

1. Demonstrate the physical properties of light.
2. Explain characteristic properties of lasers and fiber optics
3. Find the applications of quantum mechanics
4. Classify the solids depending upon electrical conductivity
5. Identify different types of semiconductors

UNIT-I

Wave Optics: Huygens' principle –Superposition of waves –Interference of light by wave front splitting and amplitude splitting–Fresnel's biprism – Interference in thin films in reflected light– Newton's rings–Fraunhofer diffraction from a single slit –Double slit diffraction – Rayleigh criterion for limit of resolution– Concept of N-slits–Diffraction grating and its resolving power.

UNIT-II

Lasers & Holography: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion –Different types of lasers: solid-state lasers: Ruby & Nd:YAG; gas lasers: He-Ne & CO_2; semiconductor laser –Applications of lasers in engineering and medicine. Holography: Principle – Recording and reconstruction–Applications.

Fiber Optics: Introduction –Construction –Principle –Propagation of light through an optical fiber – Numerical aperture and acceptance angle –Step-index and graded-index fibers –Pulse dispersion –Fiber losses–Fiber optic communication system –Applications.

UNIT-III

Principles of Quantum Mechanics: Introduction –Wave nature of particles – de-Broglie hypothesis – Physical significance of ψ –Time-dependent and time-independent Schrodinger equations – Born interpretation – Probability current –Wave packets –Uncertainty principle –Particle in infinite square well potential –Scattering from potential step – Potential barrier and tunneling.

UNIT-IV

Band Theory of Solids: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level –Density of states – Bloch's theorem for particles in a periodic potential – Kronig-Penney model – Classification of solids: metals, semiconductors and insulators.

UNIT-V

Semiconductors: Intrinsic and extrinsic semiconductors –Charge carrier concentration in intrinsic semiconductors – Dependence of Fermi level on carrier concentration and temperature in extrinsic semiconductors (qualitative) –Carrier generation and recombination –Carrier transport: diffusion and drift – P-N junction – Thermistor – Hall effect – LED –Solar cell.

Professor and Head Department

Text Books:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

Suggested Reading:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

with effect from the Academic Year 2020-21

20CS C01

PROGRAMMING FOR PROBLEM SOLVING
(Common to all Programs)

Instruction	3 Periods per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
4. Develop in tuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and understand the computing environments for scientific and mathematical problems.
2. Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
3. Choose data types and control structures to solve mathematical and scientific problem.
4. Decompose a problem into modules and use functions to implement the modules.
5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high-level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence, and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping, and nested statements.

Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes, Case study using functions and control statements.

UNIT – III

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting (Selection and Bubble) algorithms, 2-D arrays, matrix operations.

Strings: Introduction, strings representation, string operations with examples. Case study using arrays.

UNIT – IV

Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, dynamic memory allocation, advantages, and drawbacks of pointers.

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions, and enumerated data types.

UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.

Preprocessor Directives: Types of preprocessor directives, examples.

Text Books:

1. M.T. Somashekar "Problem Solving with C", 2nd Edition, Prentice Hall India Learning Private Limited 2018
2. AK Sharma, "Computer Fundamentals and Programming", 2nd Edition, University Press, 2018
3. Pradeep Deyand Manas Ghosh, "Programming in C", Oxford Press, 2nd Edition, 2017

Suggested Reading:

1. Byron Gottfried, Schaum's Outline of Programming with C", Mc Graw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Reema Tharaja "Introduction to C Programming", Second Edition, OXFORDPress,2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm.
2. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

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20MT C02

LINEAR ALGEBRA & CALCULUS LAB

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	2P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To explain basic operations of matrix algebra.
2. To discuss the behavior of the infinite Series.
3. To discuss the maxima and minima of the functions of two variables
4. To discuss Physical interpretations on Scalars and vector functions.
5. To explain vector line, surface and volume integrals.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the Matrix operations in executing various programmes.
2. Test the convergence and divergence of the infinite Series.
3. Explore the extreme values of functions of two variables.
4. Determine the gradient, divergent and curl of scalar and vector point functions.
5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems

LIST OF EXPERIMENTS:

1. Addition and multiplication of higher order matrices.
2. Determinant and Inverse of the matrices
3. Eigen values and Eigenvectors of Matrix.
4. Nature of quadratic form of Matrix.
5. Solution of system of linear equations.
6. Data plotting (2D,3D)
7. Test the convergence of infinite series
8. Examine the extreme values of given function
9. Examine the rotational, irrotational and divergence of the flows
10. Verify inter connection between vector theorems (Green's, Gauss and Stoke's Theorems)

Text Books / Suggested Reading / Online Resources:

1. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
2. https://www.scilab.org/tutorials\
3. https://nptel.ac.in/courses/106102064/
4. https://www.udemy.com/algorithms-and-data-structures-in-python/

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20EG C02

ENGLISH LAB
(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives: This course will introduce the students:

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behavior while developing their ability to discuss in groups and making oral presentations.

Course Outcomes: After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams, and discuss and participate in Group discussions.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm &Intonation:** Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material
6. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary –** weaving an imaginative story around a given picture.
9. **Information Gap Activity –** Writing a brief report on a newspaper headline by building on the hints given
10. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt. Ltd., 2011
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016

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20PY C03

OPTICS AND SEMICONDUCTOR PHYSICS LAB
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block chain Technology))

Instruction	4 Periods / week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

Course Objectives: The objectives of the course is to make the student
1. Apply theoretical physics knowledge in doing experiments
2. Understand the behaviour of the light experimentally
3. Analyze the conduction behaviour of semiconductor materials and optoelectronic devices

Course Outcomes: At the end of the course, the student will be able to
1. Interpret the errors in the results of an experiment.
2. Demonstrate physical properties of light experimentally
3. Make use of lasers and optical fibers for engineering applications
4. Explain the V-I characteristics of some optoelectronic and semiconductor devices
5. Find the applications thermistor

Experiments

1.	Error Analysis	:	Estimation of errors in the determination of time period of a torsional pendulum
2.	Fresnel's Biprism	:	Determination of wavelength of given monochromatic source
3.	Newton's Rings	:	Determination of wavelength of given monochromatic source
4.	Single Slit Diffraction	:	Determination of wavelength of given monochromatic source
5.	Diffraction Grating	:	Determination of wavelengths of two yellow lines of light of mercury lamp
6.	Laser	:	Determination of wavelength of given semiconductor laser
7.	Holography	:	Recording and reconstruction of a hologram
8.	Optical Fiber	:	Determination of numerical aperture and power losses of given optical fiber
9.	Energy Gap	:	Determination of energy gap of given semiconductor
10.	P-N Junction Diode	:	Study of V-I characteristics and calculation of resistance of given diode in forward bias and reverse bias
11.	Thermistor	:	Determination of temperature coefficient of resistance of given thermistor
12.	Hall Effect	:	Determination of Hall coefficient, carrier concentration and mobility of charge carriers of given semiconductor specimen
13.	LED	:	Study of I-V characteristics of given LED
14.	Solar Cell	:	Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance
15.	Planck's Constant	:	Determination of Planck's constant using photo cell

NOTE: A minimum of TWELVE experiments should be conducted

20CS C02

PROGRAMMING FOR PROBLEM SOLVING LAB
(Common to All Programs)

Instruction	4 Periods per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

Course Objectives: The objectives of this course are
1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

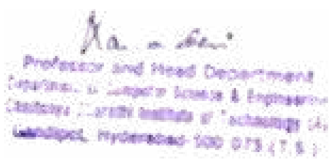
Course Outcomes: On Successful completion of the course, students will be able to
1. Identify and setup program development environment.
2. Design and test programs to solve mathematical and scientific problems.
3. Identify and rectify the syntax errors and debug program for semantic errors
4. Implement modular programs using functions.
5. Represent data in arrays, pointers, structures and manipulate them through a program.
6. Create, read, and write to and from simple text files.

Lab experiments
1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

Text Books:

1. Pradeep Dey and Manas Ghosh, "Programming in C", Oxford Press, 2nd Edition, 2017.
2. Reema Tharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015.

Online Resources:
1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/



20ME C01

CAD AND DRAFTING

Instruction	1 T + 3 D Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives:

1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

Outcomes: At the end of the course, the Students are able to

1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

List of Exercises:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice versa.

Text Books:

1. N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishers, 2012.
2. K.Venugopal, “Engineering Drawing and Graphics + AutoCAD”, New Age International Pvt. Ltd, 2011.
3. Basanth Agrawal and C M Agrawal, “Engineering Drawing”, 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., “Engineering Drawing”, 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011.

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20MBC02

COMMUNITY ENGAGEMENT

Instruction	3 Hours per week (30 hours field work & 2 hours per week)
SEE	Nil
CIE	50 Marks
Credits	1.5 Credits

Course Objectives: The main Objectives of this Course are to:

1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

Course Outcomes: After the completion of this Course, Student will be able to:

1. Gain an understanding of Rural life, Culture and Social realities.
2. Develop a sense of empathy and bonds of mutuality with Local Communities.
3. Appreciate significant contributions of Local communities to Indian Society and Economy.
4. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
5. Utilise the opportunities provided by Rural Development Programmes.

Module I Appreciation of Rural Society

Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

Module II Understanding Rural Economy and Livelihood

Agriculture, Farming, Landownership, Water management, Animal Husbandry, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III Rural Institutions

Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees, Local Civil Society, Local Administration.

Module IV Rural Development Programmes

History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

Text Books:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

Journals:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of II Semester of B.E. – Computer Science & Engineering as per AICTE Model Curriculum 2020-21

B.E. - COMPUTER SCIENCE AND ENGINEERING

SEMESTER -II

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20MT C03	Differential Equations & Transform Theory	3	-	-	3	40	60	3
2	20CYC01	Chemistry	3	-	-	3	40	60	3
3	20CS C05	Industry 4.0	3	-	-	3	40	60	3
4	20CS C03	Object Oriented Programming	3	-	-	3	40	60	3
PRACTICAL									
5	20MT C04	Differential Equations &Transform Theory Lab	-	-	2	3	50	50	1
6	20CYC02	Chemistry Lab	-	-	4	3	50	50	2
7	20CSC04	Object Oriented Programming Lab	-	-	2	3	50	50	1
8	20ME C02	Workshop / Manufacturing Practice			5	3	50	50	2.5
9	20ME C03	Engineering Exploration	90 Hours / 4P			-	50	-	1.5
TOTAL			**12**	**-**	**13**	**-**	**410**	**440**	**20**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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20MT C03

DIFFERENTIAL EQUATIONS &TRANSFORM THEORY
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IOT &Cyber Security including Block Chain Technology))

Instruction	3 L per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss the properties of Legendre's Polynomials and Bessel's functions
4. To explain the Z-Transform and InverseZ-Transforms.
5. To discuss Fourier transform for solving engineering problems.

Course Outcomes:

Upon completing this course, students will be able to:

1. Calculate the solutions of first order linear differential equations.
2. Calculate the solutions of higher order linear differential equations.
3. Examine the series solutions for higher order differential equations.
4. Evaluate the Improper integrals by Fourier Transform.
5. Solve the difference equations byZ-transforms.

UNIT - I

Differential Equations of First Order: Exact Differential Equations, Equations Reducible To Exact Equations, Linear Equations, Bernoulli's Equations, Riccati's and Clairaut's Equations, Orthogonal trajectories.

UNIT-II

Higher Order Linear Differential Equations: Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Cauchy's homogeneous linear equation. applications: LR and LCR circuits.

UNIT-III

Series Solutions of Differential Equations: Ordinary point, singular point and regular singular point, Series solution when **x=a** is an ordinary point of the equation. Legendre's equation, Legendre's Polynomial of first kind (without proof), Rodrigue's formula, orthogonality of Legendre polynomials. Bessel's equation, Bessel's function of the first kind of order n (without proof), recurrence formulae for **Jn(x)** and related problems (i.eJ0(x), J1(x), J1/2(x), J-1/2(x), J3/2 (x), J-3/2(x)).

UNIT-IV

Fourier Transforms: Fourier integral theorem (statement), Complex form of Fourier integrals. Fourier transforms, Inverse Fourier Transforms, Fourier Sine and Cosine transforms, Inverse Fourier Sine and Cosine Transforms. Properties of Fourier transforms: Linear property, change of scale property, shifting property and Modulation theorem.

UNIT-V

Z-Transforms: Definition, some standard Z-transforms, linearity property, damping rule, shifting U_n to the right, shifting U_n to the left, multiplication by 'n', initial and final value theorems. Inverse Z-Transform: evaluation of Inverse Z-transform by Convolution theorem, partial fractions method. Z- Transform application to difference equations.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley& Sons, 2006.
3. R.K.Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.

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Suggested Reading:

1. N.P.Bali and Manish Goyal, Atext book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11^{th} Reprint, 2010.
3. A.R.Vasishtha, and R.K.Guptha Integral transforms, Krishna Prakashan Media, Reprint, 2016

20CY C01

CHEMISTRY

(Common to all branches)

Instruction:	3Hours per Week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE	40 Marks
Credits:	3

Course Objectives

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

Course Outcomes

At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

UNIT-I Atomic and molecular structure and Chemical Kinetics:

Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2 , He_2^+ ,N_2 , O_2 , O_2^- , CO, NO). Pi- molecular orbitals of benzene and its aromaticity.

Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction-Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, – Reference electrodes (NHE, SCE)-electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations. Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.

Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages.

Construction, working & applications of methanol-oxygen fuel cell.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism - Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid) & Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.

Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)

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Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)
Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides)
Cyclization (Diels - Alder reaction)

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process),ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V Engineering Materials and Drugs:
Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber). Conducting polymers- Definition, classification and applications.
Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography.
Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation-Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle).
Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition (2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla, Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Readings:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

20CS C05

INDUSTRY 4.0

Instruction	3 Hours per week
Duration of End Examination	3Hours
SEE	60 Marks
CIE	40Marks
Credits	3

Prerequisite: Nil. No prior technical background is required

Course Objectives: The main objectives of this course are to:
1. Offer the students an introduction to Industry 4.0 and its applications to in the business world
2. Give deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges

Course Outcomes: On successful completion of this course, students will be able to:
1. Identify the key drivers and enablers of Industry4.0
2. Describe the smartness in smart factories, smart cities, smart products, ad smart services
3. Determine various systems used in manufacturing plants, and their role in an Industry 4.0world
4. Illustrate the power of Cloud Computing in a networked economy
5. Understand the opportunities, challenges, brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits

UNIT-1
Introduction to Industry 4.0: Various Industrial revolutions, Digitalization and the networked economy, drivers, enablers, compelling forces and challenges for Industry 4.0,Mega trends, Tipping points, comparison of Industry 4.0 Factory and Today's Factory, trends of industrial Big Data and predictive analytics for business transformation

UNIT-2
Road to Industry 4.0: Internet of Things(IoT) and Industrial Internet of Things (IIoT) and Internet of Services, smart manufacturing, smart devices and products, smart logistics, smart cities, predictive analytics

UNIT-3
Related disciplines, systems, technologies for enabling Industry 4.0: Cyber physical systems, robotic automation and collaborative robots, support system for Industry 4.0, mobile computing, related disciplines, Cyber security, Augmented Reality and Virtual Reality, Artificial Intelligence

UNIT-4
Role of data, information, knowledge and collaboration: Resource-based view of a firm, data as a new resource for organizations, harnessing and sharing knowledge in organizations, cloud computing basics, cloud computing and Industry 4.0

UNIT-5
Other Applications and Case Studies: Industry 4.0 laboratories, IIoT case studies, Opportunities and challenges, future of works and skills for workers in the Industry 4.0 era, strategies for competing in an Industry world

Text Book:

1. Klaus Schwab. The Fourth Industrial Revolution. 2017. Portfolio Penguin.
2. Pranjal Sharma. India Automated: How the Fourth Industrial Revolution is Transforming India. 2019. Macmillan; 1edition
3. https://swayam.gov.in/nd1_noc20_cs69/preview

Suggested Reading:

1. Bruno S. Sergi, Elena G. Popkova, Aleksei V. Bogoviz, Tatiana N. Litvinova. Understanding Industry 4.0: AI, the Internet of Things, and the Future of Work. 2019. Emerald Publishing Limited. ISBN: 9781789733129
2. Dominik T. Matt, Vladimír Modrák, Helmut Zsifkovits. Industry 4.0 for SMEs: Challenges, Opportunities and Requirements. Palgravemacmillan

20CS C03

OBJECT ORIENTED PROGRAMMING

Instruction	3 Periods per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Describe the principles of Object-Oriented Programming.
2. Enable the students to solve problems using OOPs features.
3. Debugging in programs and files.
4. Use of library modules to develop GUI applications.

Course Outcomes: On Successful completion of the course, students will be able to

1. Demonstrate the concepts of Object-Oriented Programming languages to solve problems.
2. Apply the constructs like selection, repetition, functions and packages to modularize the programs.
3. Design and build applications with classes/modules.
4. Find and rectify coding errors in a program to assess and improve performance.
5. Develop packages for solving simple real world problems.
6. Analyze and use appropriate library software to create graphical interface, mathematical software.

Unit-I

Introduction to Object Oriented Programming : Computer Programming and Programming Languages, Programming Paradigms, Features of Object Oriented Programming, Merits and Demerits of OOPs

Basics of Python Programming: Features of Python, Variables, Identifiers, Data types, Input/ Output operations, Operators and Expressions, Operations on Strings, Type Conversion.

Unit-II

Decision Control Statement : Selection/Conditional Branching, Loop Control Structures, Nested Loops. **Functions and Modules**: Uses of functions, Function definition, function call, Variable scope and Lifetime, Recursion, Lambda functions, map, reduce and filter built-in functions, Recursive Functions, Modules, Packages.

Unit-III

Classes and Objects: Introduction, Classes and Objects, init method, Class variables, and Object variables, Public and Private Data members, calling methods from other methods, built-in class attributes, garbage collection, class methods, static methods.

Unit-IV

Inheritance: Introduction, Inheriting classes, Polymorphism and method overloading, Composition or Containership, Abstract classes and inheritance.

Operator Overloading: Introduction, Implementation of Operator Overloading, Overriding.

File Handling: File types, opening and closing files, reading and writing files, file positions, Regular Expressions.

Unit-V

Error and Exception Handling: Introduction to errors and exceptions, Handling Exceptions, Simple GUI Programming with *tkinter* package, Sample Graphics using *Turtle*, Plotting Graphs in Python.

Text Books:

1. Reema Thareja, “Python Programming”, Oxford Press, 2017.
2. Mike Mc Grath “Python in easy steps: Makes Programming Fun”, Kindle Edition, 2017.

Suggested Readings:

1. Mark Lutz “Learning Python”, O’Reilly Media Inc., 5thEdition2013
2. Mark Summerfield “Programming in Python 3: A Complete Introduction to the Python, Addison–Wesley, 2nd Edition.

References:

1. https://anandology.com/python-practice-book/object_oriented_programming.html
2. http://python-textbok.readthedocs.io/en/1.0/Object_Oriented_Programming.html
3. http://www.tutorialspoint.com/python/python_classes_objects.html
4. https://docs.python.org/3/

20MT C04

DIFFERENTIAL EQUATIONS &TRANSFORM THEORY LAB
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IOT & Cyber Security including Block Chain Technology)

Instruction	2P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:
1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss the properties of Legendre's Polynomials and Bessel's functions
4. To explain the Z-Transform and InverseZ-Transforms.
5. To discuss Fourier transform for solving engineering problems.

Course Outcomes:

Upon completing this course, students will be able to:
1. Explore all the possible solutions of first order differential equation.
2. Analyse the solutions of higher order linear differential equations.
3. Examine the series solutions for higher order differential equations.
4. Evaluate the Improper integrals by Fourier Transform.
5. Apply the Z-transform to solve the difference equations.

List of Programmes:

1. Solution of first order liner differential equations.
2. Solution of first order non liner differential equations
3. Geometrical view of Particular integral of higher order differential equations.
4. Simulations of Legendre's differential equations.
5. Geometrical view of Rodrigue's theorem.
6. Simulations of Bessel's first kind solution.
7. Solutions of Bessel's first kind
   (i.e. J0(x), J1(x), J1/2(x), J3/2 (x), J-1/2(x), J-3/2(x))
8. Waveform generation continuous signals
9. Computation of Fourier Transformations
10. Discrete Cosine Transforms
11. Digitization of continuous functions.

Text Books / Suggested Reading / Online Resources:

1. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
2. https://www.scilab.org/tutorials\
3. https://nptel.ac.in/courses/106102064/
4. https://www.udemy.com/algorithms-and-data-structures-in-python/

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20CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	4 Hours per Week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	2

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theorical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes

At the end of the course student will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

Chemistry Lab

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2}& Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

Text Books:

1. J. Mendham and Thomas , "Vogel's text book of quantitative chemical analysis", Pearson education Pvt. Ltd. New Delhi , 6th ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg & A.Gulati,; R. Chand & Co. : New Delhi (2011).

Suggested Readings:

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

20CS C04

OBJECT ORIENTED PROGRAMMING LAB

Instruction	2 Periods per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives: The objectives of this course are

1. Identification and installation of required software to work with Python.
2. Program development using OOPs concepts.
3. Handling of errors in program code.
4. Use of library modules to develop GUI applications.

Course Outcomes: On Successful completion of the course, students will be able to

1. Inspect and identify suitable programming environment to work with Python.
2. Choose appropriate control constructs, data structures to build the solutions.
3. Develop the solutions with modular approach using functions, packages to enhance the code efficiency.
4. Analyze and debug the programs to verify and validate code.
5. Demonstrate use of STLs and modules to build graphical interfaces, mathematical software.
6. Determine the requirements of real-world problems and use appropriate modules to develop solutions.

Lab Experiments:

1. Installation of any Object Oriented Programming Language and IDE.
2. Simple scripts to demonstrate the use of basic data types and operators.
3. Simple scripts to demonstrate the use of control structures.
4. Functions and Lambda function and parameter passing.
5. Experimentation with Modules.
6. Implementation of classes with attributes and methods.
7. Demonstration of inheritance.
8. Experiments on Overloading.
9. Files and Regular Expressions.
10. Exceptions and built-in tools.
11. Experiments on System interfaces and GUIs.

Text Book:

1. Reema Thareja, "Python Programming", Oxford Press, 2017.

Online Resources:

1. https://vknight.org/cfm/labsheets/04-object-oriented-programming/
2. http://learning-python.com/class/Workbook/x-exercises.htm
3. https://inst.eecs.berkeley.edu/~cs61a/fa14/lab/lab06/#inheritance
4. https://anandology.com/python-practice-book/object_oriented_programming.html
5. http://stanfordpython.com/
6. https://docs.python.org/3/

Professor and Head Department

20ME C02

WORKSHOP / MANUFACTURING PRACTICE

Instruction	5P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive &team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes: At the end of the course, the students are able to

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
3. Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
4. Perform various operations in welding, machining and casting processes.
5. Conceptualize and produce simple device/mechanism of their choice.

List of Exercises

CYCLE 1

Exercises in Carpentry

1. To plane the given wooden piece to required size
2. To make a lap joint on the given wooden piece according to the given dimensions.
3. To make a dove tail-joint on the given wooden piece according to the given dimensions.

Exercises in Tin Smithy

1. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
2. To make a scoop.
3. To make a pamphlet box.

Exercises in Fitting

1. To make a perfect rectangular MS flat and to do parallel cuts using Hacksaw
2. To make male and female fitting using MSflats-Assembly1
3. To make male and female fitting using MSflats-Assembly2

Exercises in House Wiring

1. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch, and wiring of one buzzer controlled by a bellpush
2. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket
3. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- way switches.

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CYCLE 2

Exercises in Casting

1. Study of Sand casting process and its applications.
2. Green sand moulding practice for a single piece pattern
3. Green sand moulding practice for a split pattern with a horizontal core

Exercises in Welding

1. Study of gas welding equipment and process. Identification of flames, making of Butt joint with gas welding.
2. Study of Arc welding process, making Butt joint with DCSP,DCRP
3. Study of Arc welding process, making Lap joint with A.C

Exercises in Machine shop

1. Study of Machine Tools like Lathe, Drilling, Milling and Shaper.
2. Facing, Plain turning and Step turning operations on Lathe machine.
3. Knurling and Taper turning on Lathe machine

Open ended Exercise:

1. Student should produce a component /mechanism by applying the knowledge of any one trade or combination of trades.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I, 2008 and Vol. II, 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I", Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

20ME C03

ENGINEERING EXPLORATION
(PRACTICAL)

Instruction	4 Hours per week
Duration of SEE	Nil
SEE	Nil
CIE	50Marks
Credits	1.5

Prerequisites: Nil

Course Outcomes: At the end of the course, the students are able to

1. Understand the role of an engineer as a problem solver.
2. Identify multi-disciplinary approaches in solving an engineering problem.
3. Build simple systems using engineering design process.
4. Analyze engineering solutions from ethical and sustainability perspectives.
5. Use basics of engineering project management skills in doing projects.

UNIT- I

Role of Engineers: Introduction, science, engineering, technology, engineer, scientist, role of engineer, various disciplines of engineering, misconception of engineering, expectations for the 21st century engineer and NBA graduate attributes.

Engineering problems and Design: Multidisciplinary facet of design, pair wise comparison chart, introduction to econometrics system, generation of multiple solution, Pugh chart, motor and battery sizing concepts, introduction to PCB design.

UNIT- II

Mechanisms: Basic components of a mechanism, degrees of freedom or mobility of a mechanism, 4-bar chain, crank rocker mechanism, slider crank mechanism, simple robotic arm building.

Platform-based development: Introduction to programming platforms (Arduino) and its essentials, sensors, transducers and actuators and their interfacing with Arduino.

UNIT- III

Data Acquisition and Analysis: Types of data, descriptive statistics techniques as applicable to different types of data, types of graphs and their applicability, usage of tools (MS-Office /Open Office/ Libre Office / Scilab) for descriptive statistics, data acquisition (temperature and humidity) using sensors interfaced with Arduino, exporting acquired data to spreadsheets, and analysis using representation.

UNIT- IV

Process Management: Introduction to Agile practice, significance of team work, importance of communication in engineering profession, project management tools, checklist, timeline, Gantt chart, significance of documentation.

UNIT -V

Engineering Ethics & Sustainability in Engineering: Identifying Engineering as a profession, significance of professional ethics, code of conduct for engineers, identifying ethical dimensions in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas.

Sustainability in Engineering: Introduction, sustainability leadership, life cycle assessment, carbon foot print.

Text Books:

1. Clive L. Dym, Patric Little, Elizabeth J Orwin, “Engineering Design: A project-based introduction”, 4th edition, Willey.
2. Matthew Python, “Arduino programming for beginners”, Independently published, 2020.
3. Patrick F. Dunn , “Measurement and data Analysis for engineering and science” , thirdedition, 2014.
4. Andrew Stellman, Jennifer Greene, “Head First Agile: A brain-friendly guide to Agile principles, ideas, and real-world practices”, Kindle Edition.

Suggested Reading:

1. Charles B. Fleddermann, “Engineering ethics”, fourth edition, Prentice Hall, 2012.
2. Rob Lawlor, “Engineering in society”, second edition, Royal academy of engineering.
3. Richard Dodds, Roger Venables, “Engineering for sustainable development: Guiding principles”, The Royal Academy of engineering, 2005.
4. Richard S. Paul, “Robot Manipulators: Mathematics, Programming, and Control”, MIT Press.

ENGINEERING EXPLORATION ASSESSMENT SCHEME				
S. No	**Name of the module**	**Work Hours**	**Marks**	**Evaluation**
1	Role of Engineers	4	-	Evaluation - I
2	Engineering Design	16	5	
3	Mechanisms	6	3	
4	Engineering Ethics	2	2	
5	Platform-based Development	16	5	Evaluation - II
6	Data Acquisition and Analysis	6	4	Evaluation-III
7	Project Management	4	4	
8	Sustainability in Engineering	6	2	
9	Course Project Reviews	12	20	Final Evaluation
10	Code of conduct	-	5	
	Total	**72**	**50**	

Professor and Head Department

Model Curriculum

B.E Syllabus for III and IV Semester

With effect from 2019-20

Specialization /Branch: Computer Science and Engineering

Chaitanya Bharathi Institute of Technology (A)
Chaitanya Bharathi (P.O), Gandipet
Hyderabad-500075, Telangana State.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTION AND EXAMINATION
III-Semester of B.E, Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER – III

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
THEORY									
1.	18EEC01	Basic Electrical Engineering	3	1	0	3	30	70	4
2.	18CSC07	Data Structures	3	0	0	3	30	70	3
3.	18CSC08	Discrete Mathematics	3	1	0	3	30	70	4
4.	18CSC09	Digital Electronics and Logic Design	3	0	0	3	30	70	3
5.	18MEC09	Principles of Management	3	0	0	3	30	70	3
6.	18CEM01	Environmental Science	2	0	0	2	-	50	0
PRACTICAL									
7.	18EEC02	Basic Electrical Engineering Lab	0	0	2	2	15	35	1
8.	18CSC10	Data Structures Lab	0	0	2	2	15	35	1
9.	18CSC11	Digital Electronics and Logic Design Lab	0	0	2	2	15	35	1
10.	18EGC03	Soft Skills	0	0	2	2	15	35	1
TOTAL			**17**	**2**	**8**		**210**	**540**	**21**

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

18EE C01

BASIC ELECTRICAL ENGINEERING

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives: The objectives of this course are

1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.
3. To understand the basic concepts of Transformer.
4. To understand the basic concepts of DC machines and AC machines.
5. To know about different types of electrical wires and cables and to understand safety rules and methods of earthing.

Course Outcomes: On Successful completion of the course, students will be able to

1. Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits
2. Acquire the concepts of principle of operation of Transformers and DC machines
3. Acquire the concepts of principle of operation of DC machines and AC machines
4. Acquire the knowledge of electrical wiring and cables and electrical safety precautions
5. Recognize importance of earthing and methods of earthing and electrical installations

UNIT-I: DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of firstorder RL and RC circuits.

UNIT-II: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III: Transformers

Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation, Auto transformer.

UNIT-IV: DC and AC Machines

DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators. DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors. Three - Phase Induction Motors: Construction, Principle of operation, Torque equation, torque-slip characteristics, Power stages, speed control of induction motors.

UNIT-V: Electrical Installations and Electrical Wiring

Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules.

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Earthing, Elementary calculations for energy consumption.

Text books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, –Basic Electrical Engineering Tata McGraw Hill, 2010.
2. V. D. Toro, –Electrical Engineering Fundamentals Prentice Hall India, 1989.
3. D.C. Kulshreshtha, –Basic Electrical Engineering McGraw Hill, 2009
4. P.V.Prasad, S.sivanagaraju, R.Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013.

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18CS C07

DATA STRUCTURES

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives: The objectives of this course are

1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different balanced binary trees, which provides efficient implementation for data structures.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand the basic concepts of data structures.
2. Analyze the performance of algorithms.
3. Distinguish between linear and non-linear data structures.
4. Identify the significance of balanced search trees.
5. Establish a suitable data structure for real world applications.

UNIT - I

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff. **Recursion**: Introduction, format of recursive functions, recursion Vs. Iteration, examples. **Sorting:** Quick sort, Merge Sort, Selection Sort

UNIT - II

Linked Lists: Introduction, Linked lists, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays, Types of Linked Lists and operations-Circular Single Linked List, Double Linked List, Circular Double Linked List

UNIT- III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications

UNIT - IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Binary Trees, Tree Traversal. **Binary Search Trees:** Representation and operations. **Heap Tree:** definition, representation, Heap Sort. **Graphs:** Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.

UNIT - V

Hashing: Introduction, Hashing Functions- Modulo, Middle of Square, Folding, Collision Techniques-Linear Probing, Quadratic Probing, Double Hashing, **Balanced Search Trees:** AVL Trees, Red-Black Trees, Splay Trees, B-Trees

Text Books:

1. Narasimha karumanchi, "Data Structures and Algorithms Made Easy", Career Monk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, "Fundamentals of Data structures in C", E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, "Data Structures using C", Oxford University Press.

Suggested Reading:

1. D.S.Kushwaha and A.K.Misra, "Data structures A Programming Approach with C", PHI.
2. Seymour Lipschutz, "Data Structures with C", Schaums Outlines, Kindle Edition

Online Resources:

1. https://www.tutorialspoint.com/data_structures_algorithms/ index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data- structures-1#DS

Professor and Head Department

18CS C08

DISCRETE MATHEMATICS

Instruction	3L+1T Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objectives of this course are

1. To provide theoretical foundations of computer sciences.
2. To develop an understanding of logic, set theory, counting, functions, relations and proof techniques.
3. To familiarize with algebraic systems and graph theory.

Course Outcomes: On Successful completion of this course, student will be able to

1. Apply Propositional and Predicate logic for problem solving in various domains.
2. Understand Set Theory, Relations, Functions and Lattices as partially ordered sets.
3. Model and solve the real world problems using Generating Functions and Recurrence Relations.
4. Understand and apply the principles of graphs and trees to simple applications.
5. Study Algebraic systems and their general Properties.

UNIT - I

Fundamental Principles of counting: The Rules of Sum and Product, permutations, Combinations. **Introduction to Propositional Calculus**: Basic Connectives and Truth tables, Logical Equivalence: Laws of Logic, Logical Implication; Rules of Inference. **Predicates**: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.

UNIT - II

Sets: Sets and Subsets, Operations on sets and the Laws of Set Theory, Counting and Venn Diagrams. **Relations and Functions:** Cartesian Products and Relations, Functions: Composition of functions, one-one, Onto and Inverse of functions, Pigeon hole principle, partial ordering relations, POSET, Hasse diagrams, Lattices as Partially Ordered Sets, Equivalence relations.

UNIT- III

Generating Functions: Binomial Theorem, Generating Functions, Calculating Coefficient of generating functions.
Recurrence Relations: The First Order Linear Recurrence Relation, Second Order Linear. Homogeneous Recurrence relations with constant coefficients, Non Homogeneous Recurrence relations

UNIT - IV

Introduction to Graphs: Graphs and their basic properties - degree, path, cycle, Sub graphs, Complements and Graph Isomorphism, Euler trails and circuits, Hamiltonian paths and cycles, planar graphs, Euler formula, Graph Coloring and Chromatic polynomial. **Trees**: Definitions, Properties, Rooted Trees, Spanning Trees, Minimum Spanning trees: The Algorithms of Kruskal and Prims.

UNIT - V

Algebraic Structures: Algebraic Systems: Examples and General Properties, Semi groups and Monoids. **Groups:** Definitions and Examples, Subgroups, Homomorphisms and cyclic groups.

Text Books:

1. Ralph P. Grimaldi, “Discrete and Combinatorial Mathematics”, An Applied Introduction, 4th edition, Pearson Education, 2003.
2. R.K.Bisht, H.S.Dhami, “Discrete Mathematics”, Oxford University Press, Published in 2015.

Suggested Reading:

1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, 7th edition, Tata McGraw-Hill, 2005
2. J.P. Tremblay, R.Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, TATA McGraw-Hill Edition, 1995.
3. Joe L.Mott, Abraham Kandel, Theodore P. Baker, “Discrete Mathematics for Computer Scientists & Mathematicians”, 2nd Edition, PHI, 1986.
4. David D.Railey, Kenny A. Hunt, “Computational Thinking for the Modern Problem Solving”, CRC Press, 2014.

Online Resources:

1. https://nptel.ac.in/courses/111107058/
2. https://nptel-discrete-mathematics-5217

Professor and Head Department

18CS C09

DIGITAL ELECTRONICS AND LOGIC DESIGN

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To understand the architecture of basic building blocks, logic gates and minimization techniques including Quine-Mcclusky method.
2. To analyze and design the Combinational and Sequential circuits.
3. To familiarize the notations of HDL descriptions in Verilog.

Course Outcomes: On Successful completion of this course, student will be able to

1. Familiarize with number systems, simplification of Boolean functions.
2. Manipulate simple Boolean expressions using maps and tabulation method.
3. Design basic digital circuits in Computer Hardware and Digital system.
4. Use high level HDLs such as Verilog for the design of Combinational and Sequential circuits.
5. Configure registers and counters for different applications.

UNIT - I

Digital Systems and Binary Numbers: Digital systems, Binary numbers, Number base conversions, Octal and Hexadecimal numbers, Complements of Numbers, Binary codes. **Boolean Algebra and logic Gates:** Binary logic, Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates, Integrated Circuits.

UNIT - II

Minimization of Switching Functions: Introduction, the map method, minimal functions and their properties, the tabulation procedure, the prime implicant chart. **NAND and NOR Gates**: NAND Circuits, Two-level Implementation, Multilevel NAND Circuits, NOR Circuits. **Exclusive OR Gates**: Odd Function, Parity Generation and Checking.

UNIT- III

Combinational Logic Design: Combinational Circuits. **Analysis Procedure:** Derivation of Boolean Functions, Derivation of the Truth Table, Logic Simulation. **Design Procedure:** Decoders, Encoders, Multiplexers, Binary Adders, Adder- Subtractor, Binary Multiplier, HDL Representations – Verilog.

UNIT - IV

Sequential Circuits: Sequential circuit definitions, Latches, Flip-Flops, sequential circuit analysis, sequential circuit design, design with D Flip-Flops, designing with JK Flip-Flops, HDL representation for sequential circuits - Verilog.

UNIT - V

Registers: Registers, Shift registers. **Counters**: Ripple Counters, Synchronous Binary counters, Other Counters. **Memory and Programmable Logic**: Introduction, Random-Access Memory, Memory Decoding, Error Detection and Correction, Read-Only Memory, Programmable Logic Array (PLA), Programmable Array Logic (PAL).

Text Books:

1. Morris Mano M. and Michael D.Ciletti, “Digital Design, With an Introduction to Verilog HDL”, Pearson 5th edition, 2013.
2. ZVI Kohavi, “Switching and Finite Automata Theory”, Tata McGraw Hill 2 edition, 1995.

Suggested Reading:

1. H.T. Nagle, “Introduction to Computer logic”, Prentice Hall 1975.
2. Stephen Brown, Zvonko Vranesic, “Fundamentals of Digital Logic with VHDL design, McGraw Hill 2nd Edition, 2009.

18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are to
1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

Course Outcomes: On Successful completion of this course, student will be able to
1. Get an exposure to common electrical components and their ratings
2. Make electrical connections by wires of appropriate ratings
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer
6. Understand the basic characteristics of dc and ac machines

UNIT - I

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, companies, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT - II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT- III

Organizing: Nature and purpose of Organizing, formal and informal organizations, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT - IV

Directing: Individual and group behavior, motivation, theories of motivation, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT - V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, "Management", 10/e., Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, "Management", 6/e., Pearson Education, 2004.

Suggested Reading:

1. P.C. Tripathy & P.N. Reddy, "Principles of Management", Tata McGraw Hill, 1999
2. Harold Koontz and Cyril O'Donnell "Principles of Management'', Tata McGraw Hill, 2017

Professor and Head Department

18CE M01

ENVIRONMENTAL SCIENCE
(MANDATORY COURSE)

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: The objectives of this course are

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance.
3. To identify the importance of interlinking of food chain.
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: On successful completion of this course, student will be able to

1. Define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. Relate the social issues and the environment and contribute for the sustainable development.
4. Follow the environmental ethics.
5. Contribute for the mitigation and management of environmental disasters.

UNIT - I

Environmental Studies: Definition, Scope And Importance, Need For Public Awareness. Natural resources: Use And Over Utilization of Natural Resources - Water Resources, Food Resources, Forest Resources, Mineral Resources, Energy Resources, Land Resources.

UNIT - II

Ecosystems: Concept of an Ecosystem, Structure And Function of an Ecosystem, Role of Producers, Consumers And Decomposers, Energy Flow in an Ecosystem, Food Chains, Food Webs, Ecological Pyramids, Nutrient Cycling, Bio-Geo Chemical Cycles, Terrestrial And Aquatic Acosystems.

UNIT- III

Biodiversity: Genetic, Species And Ecosystem Biodiversity, Bio-Geographical Classification of India, India as a Mega Diversity Nation. Values of Biodiversity, Hot-Spots of Biodiversity, Threats to Biodiversity, Endangered And Endemic Species of India, Methods of Conservation of Biodiversity

UNIT - IV

Environmental Pollution: Cause, Effects And Control Measures of Air Pollution, Water Pollution, Marine Pollution, Soil Pollution, Noise Pollution And Solid Waste Management, Nuclear Hazards. Environmental Legislations: Environment Protection Act, Air, Water, Forest & Wild Life Acts, Issues Involved in Enforcement of Environmental Legislation, Responsibilities of State And Central Pollution Control Boards.

UNIT - V

Social issues and the environment: Water Conservation Methods: Rain Water Harvesting And Watershed Management, Environmental Ethics, Sustainable Development and Climate Change: Global Warming, Ozone Layer Depletion, Forest Fires, And Contemporary Issues.

Text Books:

1. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria& Sons, 2009.

Suggested Reading:

3. C. S. Rao," Environmental Pollution Control Engineering", Wiley, 1991.
4. S. S. Dara, "A Text Book of Environmental Chemistry &Pollution Control", S. Chand Limited, 2006.

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18EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives: The objectives of this course are

1. To verify the basic electrical circuit laws and theorems.
2. To determine the parameters and power factor of a coil.
3. To calculate the time and frequency responses of RLC circuits
4. To determine the characteristics of Transformers.
5. To determine the characteristics of dc and ac machines.

Course Outcomes: On Successful completion of the course, students will be able to

1. Make electrical connections by wires of appropriate ratings.
2. Understand the circuit analysis techniques.
3. Determine the parameters of the given coil.
4. Understand the basic characteristics of transformer.
5. Understand the basic characteristics of dc and ac machines.

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components
2. Verification of KCL and KVL.
3. Time response of RL and RC circuits.
4. Calculation of parameters of a choke coil by Wattmeter Method.
5. Verification of Thevenin's and Norton's theorems.
6. Turns ratio /voltage ratio verification of 1-Ph Transformers.
7. OC and SC tests on a given 1-Ph Transformer.
8. Observation of Excitation Phenomenon in Transformer.
9. Measurement of 3-Ph power in a balanced system (By 2- Wattmeter method).
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle).
11. Load test of DC Shunt motor.
12. Speed control of DC Shunt motor.
13. Load test of 3-Ph Induction motor.
14. Demonstration of LT Switchgear Equipment/Components.
15. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: At least **TEN** experiments should be conducted in the semester.

Professor and Head Department

18CS C10

DATA STRUCTURES LAB

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Pre-requisites: Any Programming Language(C/Python)

Course Objectives: The objectives of this course are to:
1. Understand basic concepts data structures and abstract data types.
2. Differentiate between linear and non-linear data structures.
3. Analyze various searching, sorting and hashing techniques.

Course Outcomes: On Successful completion of the course, students will be able to
1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Implement non-linear data structures such as trees, graphs.
4. Analyze various searching and sorting techniques.
5. Design and develop real world problem using suitable data structures.

List of Experiments
1. Implementation of Quick Sort, Merge Sort, Selection Sort.
2. Implementation of Insert, Delete and Search operations on Single Linked List.
3. Implementation of Insert, Delete and Search operations on doubly Linked List.
4. Implementation of Stack using array and linked list.
5. Converting of Infix Expression to Postfix.
6. Implement the algorithm for Evaluation of Postfix.
7. Implementation of Queue using array and linked list.
8. Implementation of Binary Tree Traversals.
9. Implementation of Binary Search Tree.
10. Implementation of Heap Sort.
11. Implementation of Graph Traversal Techniques.
12. Implementation of Hashing.

Text Books
1. Brian W Kernighan, Dennis Ritchie, “C Programming Language”, PH PTR, 2nd Edition.
2. Richard M Reese, “Understanding and Using C Pointers”, O`Reily, 2013.

Online Resources:
1. https://nptel.ac.in/courses/106102064/
2. https://www.udemy.com/algorithms-and-data-structures-in-python/

18CS C11

DIGITAL ELECTRONICS AND LOGIC DESIGN LAB

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The objectives of this course are

1. To simulate and synthesize combinational logic circuits.
2. To simulate and synthesize sequential logic circuits.
3. To write a test bench for verifying the functionality and implement procedures for any digital design.

Course Outcomes: On Successful completion of this course, student will be able to

1. Design a Digital circuit using Verilog HDL.
2. Understand various abstraction levels of a digital design.
3. Verify the functionality of a design using Test bench.
4. Simulate and synthesize combinational logic circuits.
5. Simulate and synthesize sequential logic circuits.

Write a Verilog HDL to Simulate and synthesize the following

1. Implement operators and operands using Verilog.
2. Logic Gates: AND, OR, BUFFER.
3. Arithmetic Units: Adders and Subtractors.
4. Magnitude Comparator, BCD to Excess 3, BCD to 7-segment display.
5. Multiplexers and De-multiplexers.
6. Encoders, Decoders, Priority Encoder.
7. Implementation of logic function using Multiplexers and Decoders.
8. Implementation of Ripple Carry Adder.
9. Flip-Flops.
10. Design of Synchronous Counters.

Text Book:

1. Samir Palnitkar, "Verilog HDL, A guide to Digital design and synthesis", 2/e, Pearson Education, 2008.

Suggested Reading:

1. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL", PHI, 2005.

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18EG C03

SOFT SKILLS

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The objectives of this course are:

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: On Successful completion of the course, students will be able to

1. Be effective communicators and participate in group discussions and case studies with confidence. Also be able to make presentations in a professional context.
2. Write Resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
4. Make the transition smoothly from Campus to Corporate. Also use media with etiquette and know what academic ethics are.
5. To do a live, mini project by collecting and analyzing data and making oral and written presentation of the same.

Exercise 1

Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion),
Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise).

Exercise 2

Main Topics: Advanced Group Discussion with Case studies: Dynamics of group discussion, intervention, summarizing and modulation of voice, body language, relevance, fluency and coherence. **Flipped Sessions:** Importance of Professional Updating & Upgrading (Reading & Discussions).**Writing Input:** Writing with Precision - Writing Abstracts.

Exercise 3

Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions &Practice), **Writing Input:**
Writing to Reflect - Resume Writing.

Exercise 4

Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity, **Flipped Sessions:** Corporate Culture, Etiquette & Grooming (Video Sessions and Practice through Role-play), **Writing Input:** Writing to Define - Writing an effective SOP.

Exercise 5

Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar.Elements and Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props and PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation), **Writing Input:** Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007.
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006.
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010.
4. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004.
5. Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

Professor and Head Department

20CIC01

FUNDAMENTALS OF CYBER SECURITY AND TOOLS

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	2

Pre-requisites: Basic Computer Knowledge

Course Objectives: The objectives of this course are

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Course Outcomes: On Successful completion of this course, student will be able to

1. Discuss different types of cybercrimes and analyze legal frameworks to deal with these cybercrimes.
2. Describe the usage of Tools in cybercrimes.
3. Recognize the importance of digital evidence in prosecution.
4. Analyze and resolve cyber security issues in various domains.
5. Analyze the commercial activities in the event of significant information security incidents in the Organization.
6. Understand the importance of Cyber Laws and their Legal perspective.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

CO \ PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	2	1	3	1	1	1	-	-	2	2	1	-
CO 2	3	2	2	3	3	2	1	2	2	1	-	2	3	2	2
CO 3	2	2	1	3	3	3	1	2	3	2	1	2	3	3	2
CO 4	2	3	1	3	3	3	1	2	3	2	2	3	3	3	2
CO 5	2	3	2	3	3	2	1	2	3	2	2	3	3	3	2
CO 6	1	1	1	2	1	2	2	2	1	2	-	2	1	-	2

UNIT - I

Introduction to Cyber Crime: Cyber Crime - Definition and Origins of the Word, Cyber crime and Information Security, Layered approach architecture for Cyber Security, Classification of Cyber Crimes.
Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector.

UNIT - II

Tools and Methods Used in Cybercrime: Introduction, Foot Printing Tools, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Malware Analysis: Virus and Worms, Trojan Horse , Backdoors and Ransomware, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Understanding Cyber Forensics: Introduction, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Challenges in Computer Forensics.

UNIT – IV

Security: Windows Security at the heart of the defense, Attacks against the windows work station, the focus of UNIX/Linux Security, Web Browser Attacks and Operating Safely, E-Mail Security and Operating safely when using E-Mail, Introduction to Cloud Security, Web threats for Organizations, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

UNIT - V

Cyber Laws: The Legal Perspectives, Need of Cyber laws: the Indian Context, The Indian IT Act, Amendments of Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

Text Books:

1. Sunit Belpre and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt.Ltd, 2011.
2. Dr. Eric cole, Dr. Ronald Krutz and James W. Conley, " Network Security Bible", Edition 2, Wiley India Pvt.Ltd, 2010.
3. Kevin Mandia, Chris Prosise, "Incident Response and computer forensics", Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, "Cyber Security and Cyber Laws", Paperback – 2018.
2. Mark F Grady, Fransesco Parisi, "The Law and Economics of Cyber Security", Cambridge university press, 2006.

Online Resources:

1. https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks
2. https://www.coursera.org/specializations/intro-cyber-security
3. https://www.coursera.org/learn/foundations-cybersecurity
4. https://onlinecourses.swayam2.ac.in/ugc19_hs25/preview

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20CIC02

FUNDAMENTALS OF CYBER SECURITY AND TOOLS LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	50 Marks
Credits	1

Pre-requisites: Basic Computer Knowledge

Course Objectives: The objectives of this course are
1. To understand the tools used in Cyber Crimes.
2. To understand the phases involved in planning Cyber Crimes.
3. To configure Defense Security System.

Course Outcomes: On Successful completion of this course, student will be able to
1. Use Foot Printing Tools for Information Gathering.
2. Scan and scrutinize the information gathered.
3. Understand the usage of Sniffer Tools.
4. Become familiar with Attack Launching Tools.
5. Configure the proactive defense system.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	-	2	3	1	-	1	3	3	-	2	3	3	1
CO 2	2	3	1	3	3	1	-	1	2	2	1	2	3	3	1
CO 3	2	2	2	3	3	1	-	1	2	2	1	2	3	3	1
CO 4	2	2	2	3	3	2	-	1	2	2	-	2	3	3	1
CO 5	2	3	3	2	2	2	-	1	1	1	1	2	3	3	1

LIST OF EXPERIMENTS:
1. Explore Information Gathering Tools (Foot Printing – Network Foot Printing, Website Foot Printing, DNS Footprinting, Social Network Footprinting, Email Footprinting).
2. Explore the tools for Scanning and Scrutinizing the gathered information. (IP Scanner, Port Scanner, Vulnerability Scanner, Web Application Scanner).
3. Introduction to Password Hacking Tools.
4. Analysis of Keylogger Software.
5. Introduction to Malware tools. (Virus dissemination tools, Trojans).
6. Introduction to Phishing & Sniffer Tools.
7. Study and Exploration of Different Attack Launching Tools. (DoS Attacks).
8. Study of Ransomware.

Text Books:

1. Sunit Belpre and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd, 2011.
2. Zoom, "Cyber Security Professional Lab Manual".
3. Dr. Eric cole, Dr. Ronald Krutz and James W. Conley, " Network Security Bible", Edition 2, Wiley India Pvt. Ltd, 2010.

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Online Resources:

1. https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks
2. https://www.coursera.org/specializations/intro-cyber-security
3. https://www.coursera.org/learn/foundations-cybersecurity
4. https://onlinecourses.swayam2.ac.in/ugc19_hs25/preview

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION
IV-Semester of B.E, Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER – IV

S.No	Course Code	Title of the Course	Scheme of Instruction				Scheme of Examination		
			Hours per week			Duration of SEE in Hours	Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
THEORY									
1	18ECC34	Basic Electronics	3	-	-	3	30	70	3
2	18MTC09	Probability and Statistics	3	1	-	3	30	70	4
3	18CSC12	Computer Architecture and Micro Processor	3	-	-	3	30	70	3
4	18CSC13	Data Base Management Systems	3	-	-	3	30	70	3
5	18EGM01	Indian Constitution and Fundamental Principles	2	-	-	2	-	* 50	0
PRACTICALS									
6	18ECC35	Basic Electronics Lab	-	-	2	2	15	35	1
7	18CSC14	Computer Architecture and Micro Processor Lab	-	-	3	3	25	50	1.5
8	18CSC15	Data Base Management Systems Lab	-	-	3	3	25	50	1.5
9	18CSC16	IT Workshop (Latex/Scilab)	-	1	2	3	25	50	2
		TOTAL	**14**	**2**	**10**	**-**	**210**	**515**	**19**

L: Lecture D: Drawing CIE - Continuous Internal Evaluation
T: Tutorial P: Practical SEE - Semester End Examination

18ECC34

BASIC ELECTRONICS

Instruction	3 L Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge about semiconductor physics and basic electrical engineering.

Course Objectives: The objectives of this course are
1. Describe semiconductor devices principle and to understand the characteristics of junction diode and transistors.
2. Understand working principles of Oscillators and Amplifiers.
3. Understand the working principle of the regulators and transducers.

Course Outcomes: On Successful completion of the course, students will be able to
1. Use semiconductor devices in making circuits like rectifiers, filters, regulators etc.
2. Design amplifier and oscillators
3. Compare various types of power amplifiers.
4. Analyze the principles and practices for instrument design to development the real world Problems.
5. Apply concepts of various electronic circuits.

UNIT – I
Semiconductor Theory: Energy levels, Intrinsic and Extrinsic Semiconductor, Mobility, Diffusion and Drift current, Hall effect, Law of mass action, Characteristics of P-N Junction diode, current equation, Parameters and Applications. **Rectifiers:** Half wave and Full wave Rectifiers Bridge and center tapped with and without filters, Ripple factor, regulation and efficiency.

UNIT – II
Transistors: Bipolar and field effect transistors with their h-parameter equivalent circuits, Basic Amplifiers classification and their circuits (Qualitative treatment only). **Regulators and Inverters**: Zener Diode**,** Breakdown mechanisms, Characteristics, Effect of Temperature, Application as voltage regulator.

UNIT – III
Feedback Amplifiers: Properties of Negative Feedback Amplifier, Types of Negative Feedback, Effect of negative feedback on Input impedance and Output impedance, Applications (Qualitative treatment only).
Oscillators: principle of oscillations, LC Type-Hartley, Colpitt and RC Type- Phase shift, Wien Bridge and Crystal Oscillator (Qualitative treatment only).

UNIT – IV
Operational Amplifiers: Basic Principle, Ideal and practical Characteristics and Applications-Summer, Integrator, Differentiator, Instrumentation Amplifier. **Power Amplifiers:** Operation of Class A, Class B, Class AB and Class C power amplifiers

UNIT – V
Data Acquisition systems: Study of transducers-LVDT, Strain gauge. **Photo Electric Devices and Industrial Devices:** Photo diode, Photo Transistor, LED, LCD, SCR, UJT Construction and Characteristics and their applications only. **Display Systems:** Constructional details of C.R.O and Applications.

Text Books:

1. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuits Theory”, Pearson Education, 9thedition, LPE, Reprinted, 2006.
2. Morris Mano, “Digital Design”, Pearson Education, Asia 2002.

Suggested Reading:

1. Jacob Millman and C., Halkias, “Electronic Devices”, McGraw Hill, Eight Edition, Reprint1985.
2. Ramakanth A. Gayakwad, “Op-Amps and Linear Integrated Circuits”, Prentice Hall of India, 3rd edition,1985.
3. W. D. Cooper, A. Helfric, “Electronic Instrumentation and Measurement Techniques”, PHI, 4th edition,2010.

18MT C09

PROBABILITY AND STATISTICS
(For CSE and IT)

Instruction	3 L+1T Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objectives of this course are
1. To Able to learn and Analyzing data in Linear and Non-Linear form.
2. To Able to fit the hypothetical data using probability distribution.
3. To Understand the data using the testing of Hypothesis.
4. To Able to Analyzing time series data using trend analysis.
5. To Able to formulate and get the solution of real world problem.

Course Outcomes: On Successful completion of the course, students will be able to
1. Use the principle of Least Squares approximating for estimating the value.
2. Use the basic probability for fitting the Random phenomenon.
3. Analyzing data using different methods of hypothesis testing.
4. Use the Moving Averages Methods for trend analysis.
5. Analyze the random phenomena of real world data.

UNIT – I
Basic Statistics: Measures of Central Tendency, Measures of Dispersion, Skewness (SKP & SKB) For Frequency Distribution, Kurtosis, Curve Fitting by The Method of Least Squares, Fitting of Straight Lines, Second Degree Parabola And Growth Curve. ($y = ae^{bx}, y = ax^b$ & $y = ab^x$.)

UNIT – II
Discrete Probability Distributions: Basic Probability, Conditional Probability, Bayes Theorem, Random Variable, Discrete Random Variable, Continuous Random Variable, Properties of Probability Mass Function, Probability Density Function, Mathematical Expectation Variance, Co-Variance And Properties, Poisson Distribution, MGF, CGF, Fitting of Poisson Distribution.

UNIT – III
Continuous Probability Distribution And Bivariate Distribution: Continuous Probability Distribution-Normal Distribution-Standard Normal Random Variable (MGF, Expectation, Variance, Properties of Normal Curve)-Areas Under Normal Curve-Exponential Distribution (MGF, CGF, Expectation, Variance)-Uniform Distribution (MGF, Expectation, Variance)-Bivariate Data Two Dimensional Discrete Random Variable, Continuous Random Variable, Marginal Probability Function, Properties of Joint Probability Function-Sum And Differences.

UNIT – IV
Small Sample Test: Inferential Statistics-Test of Significance-Large Sample Test For Single Proportion, Difference of Proportions, Single Mean, Difference of Means And Differences of Standard Deviations. Small Sample Test-Test For Single Mean, Differences of Means, Test For Ratio of Variances, Chi-Square Test For Goodness of Fit And Independent of Attributes.

UNIT – V
Time Series Analysis and ANOVA: One Way Classification-Assumptions For ANOVA Test-ANOVA For Fixed Effect Model-Two Way Classification-ANOVA For Fixed Effect Model-Components of Time Series-Measurement of Trend - Method of Semi Averages- Moving Averages Method (3 Years And 5 Years).

Text Books:

1. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.
2. S.C.Gupta, V.K.Kappoor, "Fundamentals of Applied Statistics", Sultan Chand and Sons, 2014.
3. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

Suggested Reading:

1. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, 3rd Ed., Wiley, 1968.

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18CS C12

COMPUTER ARCHITECTURE AND MICRO PROCESSOR

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Digital Electronics and Logic Design.

Course Objectives: The objectives of this course are
1. To understand the basic principles of Instruction Level Architecture and Instruction Execution, Memory System Design.
2. To learn various I/O devices and its operations, knowledge on Instruction Level Parallelism.
3. To impart the knowledge on Micro Programming and Pipelining techniques.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand the functional block diagram of single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
2. Design assembly language program for specified computing 16 bit multiplication, division and I/O device interface.
3. Derive flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
4. Design a memory module and analyze its operation by interfacing with the CPU.
5. Apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

UNIT - I

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi-computers. **Arithmetic:** Addition and Subtraction of Signed numbers, Design of fast adders, Multiplication of positive numbers, Signed-Operand Multiplication, Integer Division.

UNIT - II

Basic Processing Unit: Fundamental concepts, Execution of a complete instruction, Multiple-Bus organization, Hardwired control, Micro programmed control. **8086 Architecture:** CPU Architecture, Internal operation, Machine language instructions Addressing modes, Instruction formats, Instruction execution timing.

UNIT- III

Assembly Language Programming: Instruction format, Data transfer instructions, Arithmetic instructions. **Assembly Language Programming:** Branch instructions, Loop instructions, NOP and HLT, Flag manipulation instructions, Logical instructions, Shift and Rotate instructions, Directives and Operators. **Modular Programming:** Linking and Relocation, Stacks, Procedures, Interrupts and Interrupt routines, Macros and String instructions, REP prefix.

UNIT - IV

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers –Program Controlled, Interrupt Driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCSI, USB.
Pipelining: Basic concepts, Data hazards, Instruction hazards, Influence on instruction sets, Data path and control considerations, Superscalar operation, Performance considerations.

UNIT – V

The Memory System: Semiconductor RAM Memories, Cache Memories, Performance considerations, Virtual Memories, Memory Management requirements, Secondary Storage. **Large Computer Systems:** Forms of Parallel Processing, Array Processors, Structure of general purpose multiprocessors, Program parallelism and shared variables.

Text Books:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", 5th Edition, McGrawHill Education Edition 2011.
2. Yu-chengLiu, Glenn A.Gibson, "Microcomputer Systems: The 8086/ 8088 Family", 2nd Edition, PHI Learning 2011.

Suggested Reading:

1. M. M. Mano, "Computer System Architecture", 3rd edition, Prentice Hall, 1994.
2. William Stallings, "Computer Organisation and Architecture, Design for Performance", Pearson, 9th Edition, 2013.
3. Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata McGraw Hill, Revised 2nd Edition, 2007.
4. Brey B.Brey, "The Intel Microprocessor, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro-Processors-Architecture, Programming and Interfacing", 4thEdition, Prentice Hall.

18CS C13

DATABASE MANAGEMENT SYSTEMS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Discrete mathematics of computer science, Programming and data structures.

Course Objectives: The objectives of this course are

1. To become familiar with fundamental concepts of database management. These concepts include aspects of database design, database languages and database-system implementation.
2. To understand about data storage techniques and indexing.
3. To impart knowledge in transaction management, concurrency control techniques and recovery procedures.

Course Outcomes: On Successful completion of this course, student will be able to

1. Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS.
2. Design the database using ER modeling and Write queries using DDL, DML and DCL of SQL, Relational Algebra and Procedures, Functions using PL/SQL
3. Outline the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.
4. Summarize basic concepts of storage techniques like indexing, hashing and familiar with states and properties of transaction.
5. Illustrate locking, time stamp, graph and validation-based protocols for concurrency control.
6. Relate log based, ARIES recovery techniques to increase the robustness of the database, identify to resolve the deadlocks in the transaction.

UNIT - I

Introduction : Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Users and Administrators, Database System Architecture, Application Architectures.

Database Design and E-R Model: Overview of the Design Process, Data Models, The E-R Model, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Reduction to Relation Schemas.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations.

Structured Query Language: Overviews, SQL Data Types, Basic Structure of SQL Queries, Modification of the Database, Set Operations, Aggregate Functions, Data-Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT- III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization–1NF,2NF and 3 NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

Indexing: Basic Concepts, Primary Index, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files.

UNIT - IV

Hash based Indexing: Static Hashing, Extendible Hashing. **Transaction Management and Concurrency Control:** Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity.

UNIT - V

Deadlocks: Deadlock Prevention, Deadlock Detection and Recovery. **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, ARIES Recovery Method, Remote Backup Systems.

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Text Books:
1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, "An Introduction to Database Systems", Eight Editions, Pearson Education, 2006.
3. Raghu Ramakrishnan, Johnnes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2003.
4. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, "Fundamentals of Database Systems", Fourth Edition, Pearson Education, 2006.

Suggested Reading:
1. J.D.Ullman, "Principles of Database Systems", Galgotia.

Online Resources:
1. http://www.nptelvideos.in/2012/11/database-management- system.html

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18EG M01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks
CIE	-
Credits	-

Course Objectives: The objectives of this course are
1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand the making of the Indian Constitution, its features and know the importance of Directive Principles of State Policy.
2. Identify the difference between Right to Equality and Right to Freedom and acquires the legal status of Fundamental Duties.
3. Analyze the structuring of the Indian Union, distribution of powers between the Union and the States, and the role and position of President in Union Government.
4. Distinguish between the Lok Sabha and Rajya Sabha in law making while appreciating the importance of Judiciary in interpretation of law.
5. Differentiate between the Municipalities and Panchayats in their structure and functions.
6. Apply the knowledge of Indian Constitution to real-life or professional situation for better civic society

UNIT - I

Constitution of India: Introduction and salient features, Constitutional history, Directive principles of state policy - Its importance and implementation.

UNIT - II

Union Government and its Administration: Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States, Parliamentary form of government in India. **President**: role, power and position.

UNIT- III

Emergency Provisions in India: National emergency, President rule, Financial emergency

UNIT – IV

Local Self Government: District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

UNIT – V

Scheme of the Fundamental Rights & Duties: Fundamental Duties - the legal status.

Scheme of the Fundamental Rights: To Equality, to certain Freedom under Article 19, to Life and Personal Liberty under Article 21.

Text Books:
1. Indian Government & Politics, Ed Prof V Ravindra Sastry, Telugu Akademy, 2nd edition, 2018.
2. Indian Constitution at Work, NCERT, 10th edition, 2018.

Suggested Reading:
1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition,2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Online Resources:
1. http://www.nptel.ac.in/courses/103107084/Script.pdf

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18EC C35

BASIC ELECTRONICS LAB

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Prerequisite: Knowledge about semiconductor physics and basic electrical engineering.

Course Objectives: The objectives of this course are
1. Learn about various electronic components and devices.
2. Study the transistor characteristics in different modes.
3. Learn about oscillators and amplifiers.

Course Outcomes: On Successful completion of the course, students will be able to
1. Familiarize on basic electronic components, devices and system.
2. Analyze the measurements of time period, amplitude and phase of different waveforms.
3. Design and analyze the behavior of the regulator and rectifier.
4. Develop various types of oscillators and power amplifiers
5. Design the various circuits using operational amplifiers.

LIST OF EXPERIMENTS:
1. Study of Electronic components.
2. Characteristics of Semiconductor diodes (Ge, Si and Zener).
3. CRO and its Applications.
4. Half, Full wave rectifiers with and without filters.
5. Voltage Regulator using zener diode.
6. Characteristics of BJT in CE Configuration.
7. Characteristics of FET in CS Configuration.
8. Amplifier with and without feedback.
9. RC Phase shift oscillator
10. Operational Amplifier and its applications.
11. Power Amplifiers Characteristics
12. Realization of Half and Full adder

Text Books:

1. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, “Basic Electronics, a Text - Lab Manual”, 7^{th} Edition, TMH, 1994.
2. Paul B. Zbar, “Industrial Electronics, a Text - Lab Manual”, 4^{th} Edition, 2008.

18CS C14

COMPUTER ARCHITECTURE AND MICRO PROCESSOR LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Pre-requisites: Digital Electronics and Logic Design, Computer Architecture.

Course Objectives: The objectives of this course are
1. To become familiar with the architecture and Instruction set of 8086 microprocessor.
2. To provide practical hands on experience with Assembly Language Programming.
3. To provide solid foundation on interfacing the external devices to the processor according to the user requirements to create novel products and solutions for the real time problems.

Course Outcomes: On Successful completion of this course, student will be able to
1. Describe the architecture and comprehend the instruction set of 8086.
2. Understand and apply the principles of Assembly Language Programming in developing microprocessor based applications.
3. Get familiarized with different assembly language software tools.
4. Work with standard microprocessor interfaces to know how a processor will communicate with the External world.
5. Design and develop of various Embedded Applications.

LIST OF EXPERIMENTS:
1. Examining and understanding the working nature of internal components of computer like North bridge and South bridge of mother board, Memories like cache, ROM, RAM, Secondary storage devices, understanding CMOS and analyzing configuration using inbuilt or external tools.
2. Implementation of 2's complement to represent signed numbers in C/ Java/Python for a user specified bit length like 8/16 bit.
3. Implementation of Booth's Binary Multiplication algorithm in C/Java/ Python.
4. Implementation of Non restoring Division algorithm in C/Java/Python.
5. Tutorials with 8086 kit / MASM / NASM software tool.
6. Addition of 32-bit numbers using 16-bit registers.
7. Fixed-point multiplication and division.
8. Sorting hexadecimal array.
9. Code conversion from hexadecimal to decimal.
10. Packed and Unpacked BCD numbers.
11. Sum of set of BCD numbers.
12. Searching.
13. Display a string of characters using 8279.

Suggested Reading:

1. Yu-cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086/ 8088 Family", 2^{nd} Edition, PHI Learning 2011.
2. Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata McGraw Hill, Revised 2^{nd} Edition, 2007.
3. B. Brey, "The Intel Microprocessor, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro-Processors-Architecture, Programming and Interfacing", 4^{th} Edition, Prentice Hall, 1993.

18CS C15

DATABASE MANAGEMENT SYSTEMS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Course Objectives: The objectives of this course are
1. To become familiar with the concepts of structured query language.
2. To understand about programming language / structured query language (PL/SQL).
3. To become familiar with generation of form and open database connectivity.

Course Outcomes: On Successful completion of this course, student will be able to
1. Apply the built-in functions and write simple queries on various databases.
2. Perform definition and manipulation of data using SQL commands.
3. Develop complex queries using joins and nested queries.
4. Add constraints on Databases implement DCL, TCL and advanced SQL commands.
5. Develop programs using cursors, triggers, exceptions, procedures and functions in PL/SQL.

LIST OF EXPERIMENTS:

SQL:
1. Queries using Built-In functions, like aggregate functions, String Functions, Numeric Functions, Data Functions, Conversion Functions and other miscellaneous.
2. Queries using operators in SQL.
3. Queries to Retrieve and Change Data: Select, Insert, Delete and Update.
4. Queries using Group By, Order By and Having Clauses.
5. Queries on Controlling Data: Commit, Rollback and Save point.
6. Queries to Build Report in SQL *PLUS.
7. Queries for Creating, Dropping and Altering Tables, Views and Constraints.
8. Queries on Joins and Correlated Sub-Queries.
9. Queries on Working with Index, Sequence, Synonym, Controlling Access and Locking Rows for Update, Creating Password and Security features.

PL/SQL:
1. Write a PL/SQL code using Basic Variable, Anchored Declarations and Usage of Assignment Operation.
2. Write a PL/SQL code Bind and Substitution Variables, Printing in PL/ SQL.
3. Write a PL/SQL block using SQL and Control Structures in PL/SQL.
4. Write a PL/SQL code using Cursors, Exception and Composite Data Types.
5. Write a PL/SQL code using Procedures, Functions and Packages.

Note: The creation of sample database for the purpose of the experiments is expected to be pre-decided by the instructor.

Text Books / Suggested Reading:

1. “Oracle: The complete Reference”, by Oracle Press.
2. Nilesh Shah, “Databse Systems Using Oracle”, PHI, 2007.
3. Rick F Van der Lans, “Introduction to SQL”, Fourth Edition, Pearson Education, 2007.

18CS C16

IT WORKSHOP (Latex / Scilab)

Instruction	1T + 2P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course Objectives: The objectives of this course are
1. Familiarize the students with documentation and visualization tools like Latex and Scilab.
2. Development of proficiency in documentation for presentation and report writing.
3. Explore the utilities in Latex and Scilab.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the need of documentation tools.
2. Install the documentation tools.
3. Generate templates for generation report using Latex.
4. Generate templates for presentation using Beamer.
5. Explore the utilities of Scilab

LIST OF EXPERIMENTS:
1. Installation of Latex and Scilab.
2. Understanding Latex compilation, basic syntax, writing of equations, matrices, tables.
3. Page Layout –Titles, abstract, chapters, sections, references, equation, references, citation, table of contents, generating new commands, figure handling, numbering, list of figures, list of tables, generating index.
4. Packages: Geometry, hyperref, amsmath, amssymb, algorithms, algorithmic graphic, color, tiles listing.
5. Understanding of Classes: article, book, reports,
6. Beamer, slides preparation.
7. Writing Resume, question paper, articles, research papers, Presentation using beamer.
8. Basic syntax, Mathematical Operators, Predefined constants, Built in functions.
9. Scilab Programming: Functions, loops, conditional statements, handling .sci files.
10. Graphics handling: 2D, 3D, Generating .jpg files, function plotting, data plotting.
11. Solving linear equations, Eigen values and numerical analysis, iterative methods, ordinary differential equation, plotting solution curves,
12. Comparison OS Scilab with C / C++/ Matlab.

Text Books / Suggested Reading / Online Resources:
1. https://www.latex-project.org/help/documentation/
2. https://spoken-tutorial.org/tutorial ef,search?search_foss=LaTeX& search_language=English
3. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
4. https://www.scilab.org/tutorials\

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AICTE-Model Curriculum

B.E Syllabus for Semester V and VI

With effect from 2020 - 21

Specialization /Branch: Computer Science and Engineering

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Chaitanya Bharathi (P.O), Gandipet

Hyderabad-500075, Telangana State.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

SCHEME OF INSTRUCTION AND EXAMINATION
V-Semester of B.E, Model Curriculum
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-V

Sl.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18CSC17	Formal Language and Automata Theory	3	0	0	3	30	70	3
2	18CSC18	Operating System	3	0	0	3	30	70	3
3	18CSC19	Design and Analysis of Algorithms	3	0	0	3	30	70	3
4	18CSE XX	Professional Elective-I	3	0	0	3	30	70	3
5	18MTO XX	Open Elective-I	3	0	0	3	30	70	3
PRACTICALS									
6	18CSC20	Operating System Lab	0	0	3	3	25	50	1.5
7	18CSC21	Design and Analysis of Algorithms Lab	0	0	3	3	25	50	1.5
8	18CSE XX	Professional Elective-I Lab	0	0	3	3	25	50	1.5
9	18CSC22	Mini Project	0	0	3	-	50	-	1
		TOTAL	**15**	**0**	**12**		**275**	**500**	**20.5**

PROFESSIONAL ELECTIVE-I			OPEN ELECTIVE-I	
Course Code	**Title of the Course**		**Course Code**	**Title of the Course**
18CSE01	Web and Internet Technologies		18MTO 01	Decision Theory
18CSE02	GUI Programming		18MTO 02	Graph Theory
18CSE03	Image Processing		18MTO 03	Number Theory and Cryptography
18CSE04	Mobile Application Development		18MTO 04	Quantum Computing

PROFESSIONAL ELECTIVE-I LAB	
Course Code	**Title of the Course**
18CSE05	Web and Internet Technologies Lab
18CSE06	GUI Programming Lab
18CSE07	Image Processing Lab
18CSE08	Mobile Application Development Lab

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

18CSC17

FORMAL LANGUAGE AND AUTOMATA THEORY

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Discrete Mathematics, Data Structures, Algorithms.

Course Objectives: The objectives of this course are

1. Identify the hierarchy of formal languages, grammars and Design finite automata to accept a set of strings of a language.
2. Prove that a given language is regular and apply the closure properties of languages and design context free grammars, conversions into normal forms.
3. Equivalence of languages accepted by Push Down Automata and distinguish between computability and non-computability and Decidability and Undecidability.

Course Outcomes: On Successful completion of this course, student will be able to

1. Describe language basics like Alphabet, strings, grammars, productions, derivations, and Chomskyhierarchy.
2. Recognize regular expressions, formulate, and build equivalent finite automata for various languages.
3. Identify closure, decision properties of the languages and prove the membership.
4. Demonstrate context-free grammars, check the ambiguity of the grammars and design equivalent PDA to accept.
5. Use mathematical tools and abstract machine models to solve complex problems.
6. Distinguish between decidability and undecidability.

UNIT - I

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages**.** Regular languages and finite automata: Regular expressions and languages, Deterministic Finite Automata (DFA) and equivalence with regular expressions, Nondeterministic Finite Automata (NFA) and equivalence with DFA.

UNIT - II

Finite Automata and Regular Expression: From DFAs to Regular Expressions, Converting DFA's to Regular Expressions by Eliminating States, Converting Regular Expressions to Automata, Applications of Regular Expressions, and Algebraic Laws for Regular Expressions. **Properties of Regular Languages:** Proving Languages not to be Regular: The pumping lemma for Regular Languages, Applications of Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages: Testing Emptiness of Regular Languages, Testing Membership in a Regular Language. Equivalence and Minimization of Automata:

UNIT - III

Context-free Languages and Pushdown Automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, Closure properties of CFLs.

UNIT - IV

Context-sensitive Languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. **Turing Machines:** The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs.

UNIT - V

Unrestricted grammars and equivalence with Turing machines, TMs as enumerators. Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D Ullman, "Introduction to Automata Theory Languages and Computation", Third edition, Pearson Education, 2007.

Suggested Reading:

1. John C Martin. "Introduction to Language and Theory of Computation", 3rdedition, TMH, 2003.
2. Daniel Cohen, "Introduction to Computer Theory", 2ndedition, Wiley Publications, 2007.

3. Mishra K., Chandrasekaran N., “Theory of Computer Science (Automata, Languages and Computation)”, 3rd edition, Prentice Hall of India 2008.
4. Shyamalendra Kandar, “Introduction to Automata Theory, Formal Languages and Computation”, Pearson, 2013.
5. Kamala Krithivasan, Rama R. “Introduction to Automata Theory, and Computation”, Pearson 2009.

Web Resources:
1. http://courses.cs.vt.edu/cs4114/spring2012/index.php
2. www.pearsoned.co.in/KamalaKrithivasan

Professor and Head Department

18CSC18

OPERATING SYSTEMS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Programming for Problem Solving, Object Oriented Programming, Discrete Mathematics and Data Structure, Basic object-oriented design principles

Course Objectives: The objectives of this course are

1. Make the students to understand the basic components of a computer operating system, and interactionsamong the components
2. Cover an introduction on policies for scheduling, deadlocks, memory management, synchronization,system calls, and file systems.
3. Design operating system solutions

Course Outcomes: On Successful completion of the course, students will be able to

1. Define the fundamental components of a computer operating system and the interactions among them
2. Illustrate CPU scheduling algorithms, memory management techniques and deadlock handling methods
3. Build applications using semaphores and monitors to synchronize their operations
4. Analyse the performance of CPU scheduling and page replacement algorithms
5. Evaluate the structure of GNU/Linux and Android

UNIT - I

Introduction: Components of a computer operating systems, types of operating systems, operating system services, basic structure of Windows, Linux.

Processes & threads: Process states and transitions, Process Control Block (PCB), context switching, dispatcher. Threads, thread states, benefits of threads, types of threads

UNIT - II

Process Scheduling: Types of schedulers, Scheduling Criteria, scheduling algorithms, multiprocessor and real Time scheduling CPU scheduling in MS Windows

Memory Management: Memory management techniques, fragmentation, paging, segmentation, paged segmentation

UNIT - III

Inter-process Communication: Critical Section, race conditions, mutual exclusion, shared memory, message passing, semaphores and monitors, classical IPC Problems: producer-consumer, readers-writer and dinning philosopher

Deadlocks: conditions, deadlock handling methods, RAG, Banker's algorithm, deadlock recovery.

UNIT - IV

Virtual Memory: Introduction, locality of reference, page fault, thrashing, working Set, demand paging, pagereplacement algorithms, allocation of frames.

File Management: File access methods, directory structure, file system structure, Allocation methods, directory implementation, efficiency, and performance.

Disk Management: Disk structure, scheduling, reliability, disk formatting, swap space management

UNIT - V

I/O: devices, controllers, types of I/O, device drivers, Kernel I/O Structure, performance, Streams

Linux System-Design principles, modules, Process management, scheduling, memory management, I/Omanagement, file System, inter-process communication.

Mobile OS: iOS and Android architecture and SDK framework, media layer, services layer, core OS layer, filesystem.

Textbooks:

1. AviSilberschatz, Peter Galvin, Greg Gagne, " Operating System Concepts Essentials", Wiley Asia Student Edition, 9th Edition, 2015
2. William Stallings, "Operating Systems: Internals and Design Principles", Prentice Hall of India, 5th Edition, 2013.
3. Neil Smyth, iPhone iOS 4 Development Essentials Xcode, Fourth Edition, Payload media, 2011

Suggested Reading:

1. Charles Crowley, "Operating System: A Design-oriented Approach", Irwin Publishing, 1st Edition, 1996.

Online Resources:

1. https://nptel.ac.in/courses/106108101/

18CSC19

DESIGN AND ANALYSIS OF ALGORITHMS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basics of Data structures and algorithms.

Course Objectives: The objectives of this course are
1. Provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms.
2. Introduce the different algorithmic approaches for problem solving through numerous example problems.
3. Provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness.

Course Outcomes: On Successful completion of this course, student will be able to
1. List the performance metrics and design strategies of algorithms.
2. Describe the algorithmic design techniques of divide and conquer, greedy, dynamic programming,backtracking and branch and bound to solve problems.
3. Apply suitable algorithmic design techniques to solve problems.
4. Analyze the performance of a given algorithm.
5. Evaluate various algorithmic design techniques.
6. Formulate solutions to NP problem.

UNIT - I
Introduction: Characteristics of algorithm. **Analysis of algorithm:** Asymptotic analysis of complexity bounds – best, average and worst-case behavior. Performance measurements of Algorithm, Time and space trade-offs. **Analysis of recursive algorithms through recurrence relations:** Substitution method, Recursion tree method and Masters' theorem.

UNIT - II
Greedy Algorithms: The general method, Knapsack Problem, Huffman Codes, Job scheduling with deadlines. **Dynamic Programming**: The general method, 0/1 Knapsack, Travelling Salesman Problem, Matrix chain multiplication, Longest Common subsequence, Optimal Binary search tree.

UNIT - III
Backtracking: The general Method, 8-Queens Problem, Graph Coloring, Hamiltonian Cycle. **Branch-and-Bound**: The general method, FIFO branch and bound, LC branch and bound, 0/1 Knapsack Problem, Travelling Salesperson problem.

UNIT - IV
Graph Algorithms: Applications of DFS: Bi-Connected components, strongly connected components, topological sorting. **Shortest Path Algorithms**: Dijkstra's, Bellman-Ford, Floyd-Warshall and Johnson's algorithms. **Minimum Spanning Tree Algorithms**: Prim's and Kruskal's.

UNIT - V
Theory of NP-Completeness: Polynomial time, Polynomial time verification, P, NP, NP-hard and NP-Complete classes, NP-Completeness and Reducibility. **Standard NP-Complete Problems and Reduction Techniques:** The Clique Problem, vertex-cover and Subset Sum Problem.

Text Books:
1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press/McGraw-Hill, 3rd Edition, 2009.
2. E. Horowitz, sartaj sahni and sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press, 2007.

Suggested Reading:
1. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis", and Internet Examples, Wiley Second Edition.

Online Resources:
1. https://nptel.ac.in/courses/106101060/

18CSE01

WEB AND INTERNET TECHNOLOGIES
(PROFESSIONAL ELECTIVE-I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Programming and Problem Solving, Object Oriented Programming, DBMS.

Course Objectives: The objectives of this course are
1. Acquire knowledge of XHTML, Java Script and XML to develop web applications.
2. Develop dynamic web content using Java Servlets and JSP and JDBC.
3. Develop to complete web applications.

Course Outcomes: On Successful completion of the course, students will be able to
1. Develop static web sites using XHTML and Java Scripts.
2. Understand the role of XML and Java Script in web applications.
3. Write programs in java using all of its object oriented concepts.
4. Differentiate between Servlets and JSPs and use them according to the demands of the situation in developing dynamic web content.
5. Use JDBC to access a remote database in a web application.

UNIT - I

Web Basics and Overview: Introduction to Internet, World Wide Web, URL, MIME, HTTP. Introduction and basics of XHTML, Cascading Style Sheets, Introduction to XML, XML document structure, DTD, Namespacesand Schemas.

UNIT - II

The Basics of Java script: General Syntactic Characteristics, Primitive operations and Expressions, Arrays, Functions, Pattern Matching Using Regular Expressions, Document Object Model, Element Access in JavaScript, Events and Event Handling, Handling Events from Body, Button, Text Box and Password Elements. **Dynamic Documents with Java Script:** Positioning Elements, Moving Elements, Changing Colors and Fonts, Dynamic Content.

UNIT - III

The Java Language: Basics an overview of Java, The General Form of a class, Declaring Objects, Constructors, Overloading Methods, Overloading Constructors, static and final keywords, Inheritance Basics, Using Super, Using Abstract classes, Packages and Interfaces, dynamic method dispatch and Exception Handling.

UNIT - IV

J2EE Platform: Enterprise Architecture Styles, Containers and Technologies. **Servlet Programming**: Overview of Java Servlet API, Servlet Implementation, Servlet Configuration, Servlet Exceptions, Servlet Life cycle, Request and Responses. **Servlet Sessions, Context and Collaboration**: Approaches to Session tracking, Session Tracking with java servlet API, Servlet Context, Servlet Collaboration. **Filters for web applications**: Introduction to filters, filter API, Deployment descriptor for filters.

UNIT - V

JSP Basics: Introduction to JSP, Directives, Scripting Elements, Standard Objects, Design Strategies. **JSP Tag extensions**: Tag extensions, A simple Tag Anatomy of a Tag extension, Writing Tag Extensions. **Java Database Connection**: Introduction to JDBC, Database Drivers. Database Access with JDBC using servlet and jsp**:** Connection to a remote data base, CRUD operations, Callable Statement and Prepared Statement. ResultSet and RowSet objects.

Textbooks:
1. Robert W Sebesta, "Programming the World Wide Web", Pearson Education, 2013
2. CeditBuest, Subramanyam Allamraju, "Professional Java Server programming: J2EE 1.3 Edition", Apress Publications, 2007.

Suggested Reading:
1. Santosh Kumar K., "JDBC 4.2. Servlet 3.1 and JSP 2.3 Includes JSF 2.2 and Design Patterns", 2nd edition, 2016
2. 2. P. J. Deitel Deitel, H. M. Deitel – Deitel, "Internet & World Wide Web How To Program", Fourth Edition, Prentice Hall, 2007.
3. Chris Bates, "Web Programming, building intenet applications", 2nd edition, John Wiley & Sons, 2002

Online Resources:

1. https://www.w3.org/standards/webdesign/
2. https://www.w3schools.com/
3. https://devdocs.io/

Professor and Head Department

18CSE02

GUI PROGRAMMING (PROFESSIONAL ELECTIVE-I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Basics of Python Programming.

Course Objectives: The objectives of this course are
1. Understand the essence of GUI programming.
2. Identify various GUI frameworks.
3. Develop GUI based applications using GUI tools/frameworks.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand GUI frameworks / tool required for GUI programming.
2. Explore the features of PyQt for the develop GUI applications.
3. Customize GUIs by using layout managers and look-and-feel features.
4. Develop beautiful charts using the free Matplotlib Python module.
5. Design and develop UIs using threading in a networked environment to make the GUIs responsive andcompatible with Android, iOS.

UNIT - I

Introduction to GUI Programming: UI and interaction design, examples, components of GUI, comparison to other interfaces, 3-D user interfaces, and other GUI frameworks. **Introduction to PyQt5 Framework:** Overview, installation of PyQt framework, creation of a simple GUI, adding widgets to GUI, layout of widgets.

UNIT - II

Design of GUIs with Qt Designer: Installation of Qt Designer and tools, creation of a GUI, adding widgets, conversion of Qt Designer UI code to Python code.

UNIT - III

Enhancing Qt5 GUI functionality: Calling Dialogs from main window, decoupling Python code from generated UI code, building a complex GUI with PyQt5, Multi-threading to keep GUI responsive, Drag and Drop within the PyQt5 GUI.

UNIT - IV

Advanced Qt5 Programming: OpenGL Graphics library, networking and SQL database, Animation inside the GUI, CSS styling to enhancement for look-and- feel, PyQt's signals and slots, event handling.

UNIT - V

User Interface Design: Design of uesr interfaces, displaying Google and Qt5 Maps, creation of iPhone and Android Apps with Qt5. **Creation of 3D GUI with PyOpenGL and Pyglet**: PyOpenGL transforms for GUI, GUI in 3D, Pyglet transform for easy GUI, creation of slideshow using tkinter, best practices.

Text Books:
1. Burkhard A. Meier "Python GUI Programming Recipes using PyQt5", Packt, 2017.
2. Burkhard A. Meier, "Hands-on Python 3.x GUI Programming: Pack 2019.

Online Resources:
1. https://en.wikipedia.org/wiki/Graphical_user_interface#Technologies.

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18CSE03

IMAGE PROCESSING
(PROFESSIONAL ELECTIVE-I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Analysis of algorithms and linear algebra.

Course Objectives: The objectives of this course are
1. Gain the fundamentals of digital image processing.
2. Comprehend the relation between human visual system and machine perception and processing ofdigital images.
3. Provide a detailed approach towards image processing applications like enhancement, segmentation,and compression.

Course Outcomes: On Successful completion of this course, student will be able to
1. Explain the basic principles of image processing and its significance in real world.
2. Interpret various types of images and applies image transformations.
3. Evaluate various approaches for image segmentation and image restoration.
4. Define image processing methods and recognize morphological image processing techniques.
5. Recognize image compression and comprehend image compression techniques in both domains.
6. Apply image processing algorithms for real world problems.

UNIT - I
Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels. **Image Transforms:** 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

UNIT - II
Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering. **Image Enhancement (Frequency Domain):** Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

UNIT - III
Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.
Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, thresholding, Region Oriented Segmentation.

UNIT - IV
Morphological Image Processing: Basics, Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation. Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Geodesic Dilation, Erosion, Reconstruction by dilation and erosion.

UNIT - V
Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

Text Books:
1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson 4th Edition, 2018.
2. S Jayaraman, S Esakkirajan, T Veerakumar, "Digital Image Processing", McGraw Hill Education, 2010.

Suggested Reading:
1. Scotte Umbaugh, "Digital Image Processing and Analysis: Human and Computer Vision Application with using CVIP Tools", CRC Press,2nd Ed, 2011.
2. Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, "Digital Image Processing using MATLAB", McGraw Hill Education, 2nd Edition, 2010.
3. Somka, Hlavac, Boyle, "Digital Image Processing and Computer Vision", Cengage Learning (Indian edition) 2008.
4. Adrian Andrew Low, "Introductory Computer Vision Imaging Techniques and Solutions", BS Pub, Second Edition, 2008.

Online Resources:

1. https://nptel.ac.in/courses/117105079/
2. www.nptelvideos.in/2012/12/digital-image-processing-html

18CSE04

MOBILE APPLICATION DEVELOPMENT
(PROFESSIONAL ELECTIVE-I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Programming language skills, Problem solving skills, Applying technologies.

Course Objectives: The objectives of this course are
1. To demonstrate their understanding of the fundamentals of Android operating systems.
2. To demonstrate their skills of using Android software development tools.
3. To demonstrate their ability to develop software with reasonable complexity on mobile platform.

Course Outcomes: On Successful completion of the course, students will be able to
1. Interpret and Analyze Android platform architecture and features to learn best practices in Androidprogramming.
2. Design the User Interface for Mobile applications.
3. Apply Intents, Broadcast receivers and Internet services in Android App.
4. Develop database management system to retrieve and/or store data for Mobile application.
5. Evaluate and select appropriate Android solutions to the Mobile computing platform.
6. Build Android applications for complex problems.

UNIT - I
Introduction to Android Operating System: Android SDK Features, Developing for Android, Best practices in Android programming, Android Development Tools. Android application components – Android Manifest file, Externalizing resources, The Android Application Lifecycle, A Closer Look at Android Activities.

UNIT - II
Android User Interface: Introducing Layouts, User Interface (UI) Components – Editable and non editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers. Event Handling – Handling clicks or changes of various UI components. Introducing Fragments, Multi-screen Activities.

UNIT - III
Intents and Broadcasts: Introducing Intents: Using Intents to Launch Activities. Using Intent to dial a number or to send SMS. **Broadcast Receivers** –Creating Intent Filters and Broadcast Receivers: Using Intent Filters to Service Implicit Intents. Finding and using Intents received within an Activity. Notifications – Creating and Displaying notifications, Displaying Toasts.

UNIT - IV
Persistent Storage: Files – Reading data from files, listing contents of a directory, Creating and Saving Shared Preferences, Retrieving Shared Preferences. Database –Introducing Android Databases, Introducing SQLite, Content Values and Cursors, Working with SQLite Databases. Registering Content Providers, Using content Providers (insert, delete, retrieve and update).

UNIT - V
Advanced Topics: Alarms –Using Alarms. Using Internet Resources – Connecting to internet resource, using download manager. Location Based Services –Using Location-Based Services, Using the Emulator with Location-Based Services.

Text Books:
1. Reto Meier, "Professional Android 4 Application Development", Wiley India, (Wrox), 2012
2. James C Sheusi, "Android Application Development for Java Programmers", Cengage Learning, 2013

Suggested Reading:
1. Wei-Meng Lee, "Beginning Android 4 Application Development", Wiley India (Wrox), 2013

18MTO 05

DECISION THEORY(OPEN ELECTIVE-I)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The objectives of this course are

1. Identifying and develop Operations Research Models from the verbal description of real system.
2. Able to learn different techniques to get optimum solution LPP.
3. Able to understand the Mathematical tools that are needed to solve optimization problem.
4. Able to analyze the results of the different real-world problems.
5. Able to formulate the problems and solve situation using dynamic programming problem technique.

Course Outcomes: On the successful completion of this course, the student shall be able to

1. Calculate the optimum values for given objective function by LPP
2. Solve the solution for maximise the profit with minimum cost by Transportation problem.
3. Determine the optimum feasible solution for sequencing the Jobs
4. Arrange the jobs for different Machines to get optimum values
5. Measure the solution of dynamical system problems

UNIT-I

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research, Linear Programming Problem-Formulation of LPP, Graphical solution of LPP, Simplex Method, Artificial variables, big-M method.

UNIT-II

Transportation problems, Formulation, solution, unbalanced transportation problems, finding basic feasible solutions- North-west corner rule, least cost method and Vogel's approximations method, Optimality test: the steppingstone method and MODI method.

UNIT-III

Assignment model, formulation, Hungarian method for optimal solution, solving unbalanced problem, Traveling salesman problem and assignment problem

UNIT IV

Sequencing models, solution of sequencing problem-processing n jobs through 2 Machines-processing n jobs through 3 Machines-processing 2 jobs through m machines-processing n jobs through m machines.

U
NIT-V

Dynamic Programming, Characteristics of dynamic programming, Solution of LPP by dynamic programming and Network scheduling by PET/CPM.

Textbooks:

1. P. SankaraIyer, "Operations Research", Tata McGraw-Hill, 2008.
2. A.M. Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Educairons, 2005.

Suggested Reading:

1. J K Sharma, "Operations Research Theory & Applications, 3e", Macmillan India Ltd, 2007.
2. P.K.Gupta and D.S.Hira, "Operations Research", S.Chand& Co, 2007.
3. Kranti Swarup ,P.K.Gupta and Man Mohan "Operations Research", Sultan Chand & Sons, 2019.

Professor and Head Department

18MTO 02

GRAPH THEORY
(OPEN ELECTIVE-I)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The objectives of this course are
1. To discuss the basic and core concepts in Graph, Euler Graph and its path.
2. To explain the Matching and Covering in Bipartite Graph.
3. To demonstrate how Matching are used in Principles, Models underlying theory.
4. To explain One-Way Traffic, Rankings in a tournament.
5. To discuss Algorithmic approach to solve Network flow problems.

Course Outcomes: On Successful completion of this course, student will be able to
1. Identify the concepts of the Graph Theory in related problems.
2. Determine the solutions in Matching and Covers, Maximum Matching in Bipartite Graph.
3. Calculate the solutions for Matching and Faster Bipartite Matching, Matching in general graphs andrelated Algorithms.
4. Apply the Knowledge of Job sequencing, One-Way Traffic, Rankings to solve real time problems.
5. Solve combinatorial optimization problems pertaining to Network flow.
6. Construct solutions to real world problems.

UNIT – I
Introduction to Graphs and its Applications: Basics of Paths, Cycles, and Trails, Connection, Bipartite Graphs, Eulerian Circuits, Vertex Degrees and Counting, Degree-sum formula, The Chinese –Postman- Problem and Graphic Sequences.

UNIT – II
Matchings: Matchings and Covers, Hall's Condition, Min-Max Theorem, Independent Sets, Covers and Maximum Bipartite Matching, Augmenting Path Algorithm.

UNIT – III
Matchings and its Applications: Weighted Bipartite Matching, Hungarian Algorithm, Stable Matchings and Faster Bipartite Matching, Factors & Perfect Matching in General Graphs, Matching in General Graphs: Edmonds' Blossom Algorithm.

UNIT – IV
Directed graphs and its Applications: Directed Graphs, Directed Paths, Directed Cycles, Applications - A Job Sequencing Problem, Designing an Efficient Computer Drum, Making a Road System One-way, Ranking the Participants in a Tournament.

UNIT – V
Networks and its Applications: Flows, cuts, Ford-Fulkerson labelling algorithm, the max-flow min-cut theorem, Applications-Menger's theorems, Feasible flows.

Text Books:

1. J.A. Bondy and U.S.R.Murty, "Graph Theory with Applications", Springer, 2008 (Freely downloadable from Bondy's website).
2. D.B.West, "Introduction to Graph Theory", Prentice-Hall of India/Pearson, 2009 (latest impression).
3. N. Deo, "Graph Theory with Applications to Engineering and Computer Science", PHI Publication, 3rd edition, 2009.

Suggested Reading:

1. R.Diestel, "Graph Theory", Springer (low price edition) 2000.
2. F.Harary, "Graph Theory", Narosa, print 2013.
3. C.L. Liu, "Elements of Discrete Mathematics", Tata McGraw Hill, 2nd Edition, 2000.

18MTO 03

NUMBER THEORY AND CRYPTOGRAPHY
(OPEN ELECTIVE-I)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The objectives of this course are
1. To introduce impart the knowledge of cryptography before computer age.
2. To introduce discrete logarithmic problem.
3. To introduce some primality tests.
4. To introduce RSA cryptography.
5. To get on exposure to elliptic curve cryptography.

Course Outcomes: On Successful completion of this course, student will be able to
1. Count different operations of basic number theory.
2. Distinguish between public Key and related algorithms.
3. Define algebraic theorems with respect to well-known algorithms.
4. Apply the Euler's φ function and related algorithms in RSA crypto system.
5. Appraise security issues on elliptic curve cryptography.

UNIT – I
Simple substitution ciphers, Divisibility and greatest common divisors, Modular arithmetic, Prime numbers, unique factorisation, and finite fields, Powers and primitive roots in finite fields, Cryptography before the computer age Symmetric and asymmetric ciphers.

UNIT – II
The birth of public key cryptography, The discrete logarithm problem, Diffie–Hellman key exchange, The ElGamal public key cryptosystem, An overview of the theory of groups, How hard is the discrete logarithm problem? A collision algorithm for the DLP.

UNIT – III
The Chinese remainder theorem, The Pohlig–Hellman algorithm, Rings, quotients, polynomials, and finite fields, Euler's formula and roots modulo pq, Primality testing.

UNIT – IV
The RSA public key cryptosystem ,Implementation and security issues, Pollard's p−1 factorisation algorithm, Factorisation via difference of squares, Smooth numbers and sieves.

UNIT – V
Elliptic curves, Elliptic curves over finite fields, The elliptic curve discrete logarithm problem, Elliptic curve cryptography.

Textbooks:
1. Mathematical Cryptography by JefreyHostein, Jill Pipher, Joseph H. Silverman Springer Science+ Business Media, LLC.
2. G.A. Jones & J.M. Jones, "Elementary Number Theory", Springer UTM, 2007.

Suggested Reading:
1. Keith Martin, "Everyday Cryptography: Fundamental Principles and Applications"
2. N. P. Smart, "Cryptography: An Introduction" 3rd edition, Springer,2016.

18MTO 04

QUANTUM COMPUTING
(OPEN ELECTIVE-I)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The objectives of this course are
1. To translate fluently between the major mathematical representations and its quantum operations.
2. To implement basic quantum algorithms.
3. To explain quantum decoherence in systems for computation.
4. To discuss the physical basis of uniquely quantum phenomena.

Course Outcomes: On Successful completion of this course, student will be able to
1. Identify the working of a Quantum Computing Program, its architecture and program model.
2. Compute basic mathematical operations.
3. Demonstrate quantum logic gate circuits.
4. Develop quantum algorithm.
5. Appraise quantum algorithm on major toolkits.

UNIT – I

Introduction to Quantum Computing: Motivation for Studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc), Origin of Quantum Computing, Overview of major concepts in Quantum Commuting (Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement).

UNIT – II

Math Foundation for Quantum Computing: Matrix Algebra: Basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen Vectors.

UNIT – III

Building Blocks for Quantum Program: Architecture of a Quantum Computing Platform, Details of q-bit system of information representation (Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from Quantum algorithmic perceptive e.g. Bell State.

UNIT – IV

Quantum Logic gates and Circuits: Quantum Logic gates and Circuit:Pauli, Hadamard, Phase shift, controlled gates, ising, Deutsch, Swap etc.), Programming model for a Quantum Computing program (Steps performed on classical computer, steps performed on Quantum Computer, Moving data between bits and qubits).

UNIT – V

Quantum Algorithms: Basic techniques exploited by quantum algorithms (Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum walks), Major Algorithms (Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm), OSS Toolkits for implementing Quantum program (IBM quantum experience, Microsoft Q, Rigetti PyQuil (QPU/QVM)).

Textbooks:
1. Michael A.Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley

Suggested Reading:
1. Jack D. HidaryQuantum Computing - An Applied Approach (Springer) 2019

Professor and Head Department

18CSC20

OPERATING SYSTEMS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Course Objectives: The objectives of this course are
1. Familiarize the students with GNU/Linux environment
2. To design and apply the process management concepts.
3. To design and apply the storage management concepts.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Able to use and develop shell scripts for process management
2. Demonstrate CPU scheduling and page replacement algorithms
3. Demonstrate GNU/Linux interprocess communication mechanisms and deadlock detection using Banker's algorithm
4. Evaluate CPU scheduling and page replacement algorithms
5. Design and create system calls

LIST OF EXPERIMENTS
1. Explore basic GNU/Linux utilities and vim/gvim editor features
2. Demonstration of process management system calls
3. Demonstration of thread related system calls
4. Demonstration of CPU scheduling algorithms
5. Performance evaluation of CPU scheduling algorithms
6. Demonstration of GNU/Linux IPC mechanisms- semaphores, shared memory, message passing
7. Evaluation of page replacement algorithms
8. Implementation of producer-consumer, readers- writers and dining philosopher's problem using semaphores
9. System call implementation

Textbooks:

1. K A Robbin and Steve Robbins "UNIX Systems Programming", PHI, 2003.
2. Deitel and Deitel, "Operating System", Pearson Education, New Delhi, Third Edition, 2007.

Online Resources:
1. https://www.kernel.org/
2. https://www.kernel.org/doc/html/v4.10/process/adding-syscalls.html

Professor and Head Department

18CSC21

DESIGN AND ANALYSIS OF ALGORITHMS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: PPS, Basics of Data structures and algorithms lab and OOP.

Course Objectives: The objectives of this course are

1. Design and construct simple programs by using the different design strategies for solving different problems.
2. To enhance programming skills while improving their practical knowledge in implementing the algorithms.
3. To strengthen the practical ability and to apply suitable algorithmic approaches for solving real time problems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Identify and setup environment for the implementation of algorithms.
2. Implement divide and conquer, greedy, dynamic programming, backtracking and branch and boundtechniques.
3. Demonstrate various algorithmic design techniques.
4. Analyze the performance of various algorithms.
5. Compare various design strategies.
6. Formulate solutions to solve real world problems use acquired knowledge.

The following task should be carried out by the students in the laboratory for each experiment:-

1. Setup the environment for the experiment.
2. Select appropriate design technique to implement the problem.
3. Represent the solution using algorithm
4. Analyze the performance of the algorithm (Time and Space complexity)
5. Justify the performance of your solution is better than other strategies.

By performing the above task for each experiment the following COs are achieved,

Course Outcome	1	2	3	4	5	6
Task	1	2	3	4	5	*

*As all the questions are real world applications so CO6 is achieved

List of Experiments:

1. You are given the task of choosing the optimal path to connect 'N' devices. The devices are connected with the minimum required N-1 wires into a tree structure, and each device is connected with the other with a wire of length 'L' ie 'D1'connected to 'D2' with a wire of length 'L1'. This information will be available for all 'N' devices.
   a) Determine the minimum length of the wire which consists of N-1 wires that will connect all devices.
   b) Determine the minimum length of the wire which connects Di and Dj
   c) Determine the minimum length of the wire which connects Di to all other devices.
   d) Determine the minimum length of the wire which connects Di to all other devices where 1≤i≤N.
2. An X-ray telescope (XRT) is a telescope that is designed to observe remote objects in the X-ray spectrum. In order to get above the Earth's atmosphere, which is opaque to X-rays, X-ray telescopes must be mounted on high altitude rockets, balloons or artificial satellites. Planets, stars and galaxies and the observations are to be made with telescope. Here the process of rotating equipment into position to observe the objects is called slewing. Slewing is a complicated and time consuming procedure handled by computer driven motors. The problem is to find the tour of the telescope that moves from one object to other by observing each object exactly once with a minimum total slewing time.
3. CSE department of CBIT want to generate a time table for 'N' subjects. The following information is given- subject name, subject code and list of subjects code which clashes with this subject. The problem is to identify the list of subjects which can be scheduled on the same time line such that clashes among them do not exist.
4. A Test has 'N' questions with a heterogeneous distribution of points. The test-taker has a choice as to which questions can be answered. Each question Qi has points Pi and time Tito answer the question, where 1≤i≤N. The students are asked to answer the possible subsets of problems whose total point values add up to a maximum score within the time limit 'T'. Determine which subset of questions gives student the highest possible score.
5. Given N items with their corresponding weights and values, and a package of capacity C, choose eitherthe entire item or fractional part of the item among these N unique items to fill the package such that the package has maximum value.
6. Given a bunch of projects, where every project has a deadline and associated profit if the project is finished

before the deadline. It is also given that every project takes one month duration, so the minimum possible deadline for any project is 1 month. In what way the total profits can be maximized if only one project can be scheduled at a time.

7. N-Queen is the problem of placing ‘N’ chess queens on an N×N chessboard. Design a solution for this problem so that no two queens attack each other.
   Note: A queen can attack when an opponent is on the same row, column or diagonal.
8. Bi-connected graphs are used in the design of power grid networks. Consider the nodes as cities and the edges as electrical connections between them, you would like the network to be robust and a failure at one city should not result in a loss of power in other cities.
9. Consider a source code structure where you are building several libraries DLLs (Dynamic- Link Library) and they have dependencies on each other. For example, to build DLL , you must have built DLLs B, C and D (Maybe you have a reference of B,C and D in the project that builds A).

Textbooks:

1. Thomas H Cormen, Charles E Lieserso, Ronald L Rivesr and Clifford Stein, “Introduction to algorithms”, 3rd Edition, MIT Press/McGraw-Hill, 2009
2. Michel T Goodrich and Roberto Tamassia, “Algorithm Design: Foundations, Analysis and Internet Examples”. Second Edition, Wiley, 2001.

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18CSE05

WEB AND INTERNET TECHNOLOGIES LAB
(PROFESSIONAL ELECTIVE-I LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Programming and Problem Solving, Object Oriented Programming, DBMS.

Course Objectives: The objectives of this course are

1. To acquire knowledge of XHTML, Java Script and XML to develop web applications.
2. Ability to develop dynamic web content using Java Servlets, JSP and JDBC.
3. To understand the design and development process of a complete web application.

Course Outcomes: On Successful completion of this course, student will be able to

1. Students will be able to develop static web sites using XHTML and CSS
2. Validate form data and create dynamic content using javascript
3. Develop Dynamic web content using Java Servlets and JSP
4. Handle Sessions and use servlet filters in web applications.
5. Validate form data and create dynamic content using javascript

LIST OF PROGRAMS

1. Design simple web pages using XHTML and CSS.
2. Categorize the content of web page using XML and validate using DTD and XML schema.
3. Create well structured, easily maintained web pages using CSS and Java script.
4. Examine dynamic web pages using Java script.
5. Design a dynamic webpage that meets specified requirements and interests of end users.
6. Apply the concepts of Inheritance and interfaces to solve complex problems.
7. Analyse and apply the concepts of Exception handling and packages.
8. Handling HTTP Sessions in web applications.
9. Demonstrate Servlet Collaboration using Servlet Context.
10. Creation of dynamic content in web application using JSP.
11. Provide a program level interface for communicating with database using JDBC.

Text Books:

1. Robert W Sebesta, “Programming the World Wide Web”, Pearson Education, 2013
2. Cedit Buest, Subramanyam Allamraju, “Professional Java Server programming: J2EE 1.3 Edition”, Apress Publications, 2007.

Suggested Reading:

1. Santosh Kumar K, “JDBC 4.2, Servlet 3.1 and JSP 2.3 Includes JSF 2.2 and Design Patterns”, 2nd edition, 2016.

Online Resources:

1. https://www.w3schools.com/
2. https://www.tutorialspoint.com/servlets/index.htm.
3. https://www.oracle.com/technical-resources/articles/javase/servlets-jsp.html

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18CSE06

GUI PROGRAMMING LAB
(PROFESSIONAL ELECTIVE-I LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Basics of Python Programming.

Course Objectives: The main objectives of this course are
1. To familiarize the students with GUI development tools/frame works.
2. To Explore the features of PyQt and GUI Module.
3. To prepare the students developing GUI Applications.

Course Outcomes: On Successful completion of this course, student will be able to
1. Install and explore the features of selected IDE and frameworks.
2. Create widgets, buttons, tools and customize them using layout management tools.
3. Design user interfaces for the selected problem.
4. Implement the designed UI using PyQt and Dt Designer.
5. Customize UIs by using threading and make them responsive that are compatible with Android and iOS.

LIST OF PROGRAMS
1. Identification and installation of required software and tools.
2. Exploration of the installed IDEfor the development of GUI based applications
3. Demonstration of various buttons and tools.
4. Layout management of Widgets, buttons usngPyQt layout management tools.
5. Applying multithreading to make the GUI responsive.
6. Installation and exploration of Qt Designer.
7. Understanding and I/O requirements gathering for the selected problem.
8. Design of UI for the selected problem.
9. Implementation of the selected problem.
10. Enhancement of UI with CSS, event handling.
11. Applying 3D transformations using PyOpenGL.
12. Creation of slideshow using Tkinter.

Sample problems: Student marks management, Leave management, Attendance management, bank management, Student gate pass system, library management system, salary management system, canteen billing system, Bus ticket reservation system, Flight reservation system etc

Text Books:
1. Burkhard A. Meier "Python GUI Programming Recipes using PyQt5", Packt, 2017
2. Burkhard A. Meier, "Hands-on Python 3.x GUI Programming: Pack 2019

Online Resources:
1. https://www.tutorialspoint.com/python/python_gui_programming.htm
2. https://www.geeksforgeeks.org/python-gui-tkinter/

18CSE07

IMAGE PROCESSING LAB
(PROFESSIONAL ELECTIVE-I LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Basics of programming language.

Course Objectives: The objectives of this course are
1. To impart knowledge about the fundaments concepts of digital image processing.
2. To study various image transformation and enhancement techniques used in digital image processing.
3. To discuss about the image reformation, segmentation techniques used in digital image processing.

Course Outcomes: On Successful completion of this course, student will be able to
1. Identify the fundamental issues and challenges of image processing.
2. Translate images from spatial to frequency domain by applying various transformations.
3. Perform point operations and filtering in both domains.
4. Apply various techniques to enhance and analyze the image in detail.
5. Interpret various compression techniques and edge detection methods.
6. Evaluate Image processing algorithms for real-world problems.

LIST OF THE EXPERIMENTS:
1. Implement Point processing on images in spatial domain.
    a. Negation of an image.
    b. Thresholding of an image.
    c. Contrast Stretching of an image.
2. Implement Bit Plane Slicing on images.
3. Implement Histogram Equalization on images.
4. Implement Histogram Specification on images.
5. Implement Zooming by interpolation and replication on images.
6. Implement Filtering in spatial domain
    a. Low Pass Filtering
    b. High Pass Filtering
    c. Median filtering.
7. Implement Edge Detection using derivative filter mask
    a. Prewitt
    b. Sobel
    c. Laplacian
8. Implement Data compression using Huffman coding
9. Implement filtering in frequency domain
    a. Low pass filter
    b. High pass filter
10. Implement Hadamard transformation.

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, 4th Edition, Pearson, 2018
2. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image Processing”, - Mc Graw Hill Education, 2010.

Suggested Readings:

1. Scotte Umbaugh, “Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools”, 2nd Ed, CRC Press, 2011
2. Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, “Digital Image Processing using MATLAB”, 2nd Edition, Mc Graw Hill Education, 2010.

18CSE08

MOBILE APPLICATION DEVELOPMENT LAB
(PROFESSIONAL ELECTIVE-I LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Programming language skills, Problem solving skills.

Course Objectives: The objectives of this course are
1. To learn how to develop Applications in android environment.
2. To learn how to develop user interface applications.
3. To learn how to develop URL related applications.

Course Outcomes: On Successful completion of this course, student will be able to
1. Analyze all the components and their properties of various Emulators to select appropriate Emulator for Android App.
2. Apply essential Android programming concepts for developing efficient Mobile App.
3. Develop Android applications related to various Layouts.
4. Design applications with rich User interactive Interfaces.
5. Develop Android applications related to Mobile related server -less database like SQLite.
6. Extend Event Handling to develop various Mobile applications.

The student is expected to be able to do the following problems, though not limited.
1. Create an Android application that shows Hello + name of the user and run it on an emulator. (b) Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.
2. Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button. Use (a) Linear Layout, (b) Relative Layout and (c) Grid Layout or Table Layout.
3. Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a "Back" button. If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on right fragment instead of second screen with back button. Use Fragment transactions and Rotation event listener.
4. Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.
5. Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.
6. Create an application that uses a text file to store user names and passwords (tab separated fields and one record per line). When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with Login Failed message.
7. Create a user registration application that stores the user details in a database table.
8. Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially. Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user.

Tools:
1. Geny Motion Emulator.
2. Android Application Development with MIT App Inventor: For the first one week, the student is advised to go through the App Inventor from MIT which gives insight into the various properties of each component. The student should pay attention to the properties of each component, which are used later in Android programming.

Following are useful links:
1. http://ai2.appinventor.mit.edu
2. https://drive.google.com/file/d/0B8rTtW_91YclTWF4czdBMEpZcWs/view

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18CSC22

MINI PROJECT

Instruction	3Hours per week
CIE	50 Marks
Credits	1

Objective: The main objective of this mini project is to explore and strengthen the understanding of fundamentals through practical application of theoretical concepts. It enables the students to design and develop solutions to real world problems by applying programming knowledge to become a good engineer. It acts like a beginners guide to do larger projects later in their career.

Course Outcomes: At the end of the course, students will be able to

1. Identify and understand the real world problems.
2. Formulate the solutions to the problems by applying Computer Science and Mathematical fundamentals.
3. Represent the solutions by using various design aids/charts/diagrams.
4. Implement the solutions using modern tools/languages.
5. Analyze and interpret the experimentation results, draw conclusions
6. Communicate effectively through technical reports and presentation according to the documentation/report guidelines

Some of the guidelines for Mini Project:

1. **Selection of Topic**: Selection of topic is a huge and important task in a Mini Project. One should have a clear idea about one's subject strengths and the selected topic should be relevant to it. Always select the project that has value addition. As a graduate you should select a project which is either advantageous to a lot of people or enhance your technical and managerial skills. Your project must play its role towards a positive growth/development in that specific field.
2. **Research about the selected topic online:** Do some online research about the selected topic. Go through the research papers from different researchers around the world on the topics related to Mini Project. Find some websites containing the information about the materials used for Mini Project.
3. **Suggestions from subject experts:** Go to the subject experts in your department and interact with them about the Mini Project topic. You can also meet many subject experts from other department or various parts of the society through physically or social media and some discussion forums. This helps you in getting suggestions in different possible ways, through which you can get a clear idea on your Mini Project topic.
4. **Planning:** After getting a clear idea about the topic, prepare a rough plan about procurement of resources, experimentation and fabrication along with your teammates. Make a rough schedule, adapt to it and distribute the work among your teammates. This will keep your Mini Project on track and individuals will come to know about their part in the Mini Project rather than any individual (leader) taking full responsibilities.
5. **Execution of plans:** Make sure that the materials will be ready for the experimentation/fabrication by the scheduled time. Follow the schedule during experimentation/fabrication to get accurate and efficient results.
6. **Presentation:** Experimentation/Fabrication does not make a Mini Project successful; one should be able to present the results in proper way. So it should be prepared in such a way that, it reflects the exact objective of your Mini Project.

Guide lines / Instructions:

1. Each Mini project must be done in a group of 2-3 students.
2. Choose the topic/problem related to the fields/courses studied earlier or current semester
3. Each group must prepare a title of the mini project that relates to any engineering discipline and the title must emulate any real-world situation / problem.
4. Submit an early proposal (1-2 pages report describing what is the project about and the outcome of the final product would be, by the end of **Fourth Week**.
5. The title must be submitted to the respective lecturer by the end of week 9
6. Report must be submitted during the project presentation (**14th Week**)
7. Students are required to carry out the mini project in any one of the areas/courses that they have studied earlier or studying currently.
8. The progress of the mini project is monitored by the mentor and coordinator **every week**. Each student has to maintain a **project diary** duly signed by the mentor

Assessment:

1. 10% Early proposal (abstract)
2. 50% Continuous evaluation (progress of the project including literature review, design, development, coding, documentation according to the time lines)
3. 20% presentation and demonstration (structured, fluent, logic, output) ; 10% Viva Voce (Evaluated by internal PRC-Project Review Committee)
4. 10% Final Report writing

Professor and Head Department

Report: A report must contain the complete project details. The layout or the organization of the report as follows:

- Summary / Abstract
- Introduction
- Software specifications
- Design of the problem (Block diagram / structured chart; Flow Chart functions or Pseudocode for the subprogram
- Results and Discussions
- Conclusion and Future work
- References, Appendix and coding. System manual-How to use the system

Note: Please find the specimen copy of the project report in the institute website.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
SCHEME OF INSTRUCTION AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING

SEMESTER –VI

S. No	Course Code	Title of the Course	Scheme of Instruction: Hours per Week			Duration of SEE in Hours	Scheme of Examination: Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
THEORY									
1	18CSC23	Data Communication and Computer Networks	3	0	0	3	30	70	3
2	18CSC24	Software Engineering	3	0	0	3	30	70	3
3	18CSC25	Artificial Intelligence	3	0	0	3	30	70	3
4	18CSE XX	Professional Elective-II	3	0	0	3	30	70	3
5	18CSE XX	Professional Elective-III	3	0	0	3	30	70	3
6	18MBC 01	Engineering Economics and Accountancy	3	0	0	3	30	70	3
7	18EEM 01	Indian Traditional Knowledge	2	0	0	2	-	50	0
PRACTICAL									
8	18CSC26	Data Communication and Computer Networks Lab	0	0	3	3	25	50	1.5
9	18CSC27	Case Study	0	0	2	2	50	-	1
		TOTAL	**20**	**00**	**05**		**255**	**520**	**20.5**

PROFESSIONAL ELECTIVE-II	
Course Code	**Title of the Course**
18CSE09	Internet of Things
18CSE10	Parallel and Distributed Algorithms
18CSE11	Cloud Computing
18CSE12	Computer Vision

PROFESSIONAL ELECTIVE-III	
Course Code	**Title of the Course**
18CSE13	Soft Computing
18CSE14	Network and System Administration
18CSE15	Mobile Computing
18CSE16	Free and Open-Source Software

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

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18CSC23

DATA COMMUNICATION AND COMPUTER NETWORKS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basic programming and problem solving.

Course Objectives: The objectives of this course are

1. To understand the principles of data communication and organization of computer networks
2. To analyze various routing and congestion control algorithms.
3. To study the functionality of the transport layer and understanding different application layer protocols.

Course Outcomes: On Successful completion of this course, student will be able to

1. Define the communication protocol suites like ISO-OSI and TCP/IP.
2. Illustrate and explain Data Communications System and its components.
3. Identify and analyze various routing algorithms, congestion control algorithms.
4. Distinguish the internet protocols like IP, ARP, ICMP, IGMP, BGP, OSPF, and DHCP.
5. Outline the transport layer protocols like TCP, UDP, RTCP.
6. List and examine the applications of HTTP, WWW, DNS, Email, FTP and the underlying protocols.

UNIT - I

Introduction: Data communication, network types and models, TCP/IP and OSI Protocol Suite, transmission media (wired and wireless), switching.

UNIT - II

Data Link Layer: Design issues, error detection and correction, elementary data link protocols, sliding window protocols, multiple access protocols.

LAN: Wired LAN, wireless LAN, connecting devices and wireless LAN.

UNIT - III

Network Layer: Network layer design issues, routing algorithms, congestion control algorithms, Quality of service, IPV4, IPV6, Internet, network layer protocols -ARP, RARP, BOOTP and DHCP.

UNIT - IV

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP, congestion control, quality of service.

UNIT - V

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls.

Textbooks:

1. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw– Hill, Fifth Edition, 2013.
2. S. Tanenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2013
3. William Stallings, "Data and Computer Communication", Eighth Edition, Pearson Education, 2007.

Suggested Reading:

1. Larry L.Peterson, Peter S. Davie, "Computer Networks", Elsevier, Fifth Edition, 2012. 2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top–Down Approach Featuring the Internet", Pearson Education, 2005.

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105081/
2. https://nptel.ac.in/courses/106/106/106106091/

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18CSC24

SOFTWARE ENGINEERING

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are
1. To understand the Software Engineering Practice & Process Models.
2. To understand Design Engineering, and Software Project Management.
3. To gain knowledge of the overall project activities.

Course Outcomes: On Successful completion of this course, student will be able to
1. State the software process and the perspective process model, evolutionary and agile process models.
2. Interpret the Requirements of Software Product and Estimate the cost of software using empiricalmodels.
3. Demonstrate the skills necessary to specify the requirements of software product.
4. Recall the design principles and construct a product using coding principles and standards.
5. Prepare test cases and Apply software testing methods like White Box, Black box, and O-O.
6. Identify the configuration Management and estimates software quality and metrics of maintenance.

UNIT - I

Introduction to Software Engineering: The nature of Software, Software Engineering, The Software Process**,** Software Engineering Practice. **Process Models:** A Generic Process Model, Process Framework, CMMI, Prescriptive Process Models: Waterfall Model, Incremental Process Models, Evolutionary Process Models -Prototyping, The Spiral Model, Concurrent Models. **An Agile View of Process**: Agility, Agile Process, and Agile Process Models- Extreme Programming (XP), Adaptive Software Development (ASD).

UNIT - II

Requirement Engineering: Understanding Requirements: Establishing the Groundwork, Requirement Engineering tasks, Initiating the Requirements Engineering Process, Eliciting Requirements. **Software Requirements Analysis and Specification**: Problem Analysis, Requirements Specification, Decision Tables, SRS Document, IEEE Standards for SRS, Case Studies. **Planning and Managing the Project**: Managing Software Project, Project Personnel, Effort Estimation, Risk Management, the Project Plan and Software project estimation – Empirical estimation models.

UNIT - III

Design Engineering: Design Principles, Design Notation and Specification, Design Concepts, Flow oriented modeling. The function-oriented design for the case studies, O-O Design Concepts, Modeling Component-Level Design. **Architectural Design:** Software Architecture, Data Design, A Brief Taxonomy of Architectural Styles. **Implementation:** Coding Principles and Standards, Coding Process, Code Verification.

UNIT - IV

Testing Strategies: A Strategic approach to software testing, strategic issues, test strategies for Conventional and O-O Software, Validation Testing, System Testing, Art of Debugging. **Testing Tactics**: Software Testing Fundamentals, White Box Testing: Basis Path Testing, Control Structure Testing, O-O Testing methods. Black Box Testing

UNIT - V

Software Quality Assurance – Managing Software Project, Quality concepts Software Quality Assurance Software Reviews, Technical Reviews, Software Reliability. **Software Configuration Management**: Identification of Objects in the Software Configuration, Configuration Audit, SCM standards. **Software Maintenance**: Categories of Maintenance, Software reuse, Metrics for maintenance.

Text Books:
1. Roger S. Pressman, "Software Engineering: A practitioner's approach", 7th edition, McGraw Hill, 2010.
2. Shari Lawrence Pfleeger, "Software Engineering Theory and Practices", 4th Edition, Pearson Education, India, 2011.
3. Pankaj Jalote"An integrated approach to Software Engineering", Springer/ Narosa, 2014

Suggested Reading:
1. Sommerveli "Software Engineering", 10TH Edition, Pearson,2015
2. Rajib Mal "Fundamental of Software Engineering", 4th Edition, PHI Learning, 2014.

Online Resources:
1. https://nptel.ac.in/courses/106101061/

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18CSC25

ARTIFICIAL INTELLIGENCE

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Data structures, Discrete Mathematics, Probability Theory.

Course Objectives: The objectives of this course are
1. To list the significance of AI.
2. To discuss the various components that is involved in solving an AI problem.
3. To analyze the various knowledge representation schemes, reasoning and learning techniques of AI.

Course Outcomes: On Successful completion of this course, student will be able to
1. Explain the role of agents and interaction with the environment to establish goals.
2. Identify and formulate search strategies to solve problems by applying suitable search strategy.
3. Compare and contrast the various knowledge representation schemes of AI.
4. Appraise probabilistic reasoning and Markov decision process to solve real world problems.
5. Apply the AI concepts to build an expert system to solve the real-world problems.
6. Describe learning paradigms in machine learning.

UNIT - I

Introduction: Concept of AI, history, current status, scope, Problem Formulations, Review of tree and graph structures. **Intelligent agents:** Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - II

Problem Solving - State - Space Search and Control Strategies: State space representation, Search graph and Search tree. Random search, Search with closed and open list, Depth first and Breadth first search. Heuristic search, Best first search. A* algorithm, problem reduction, constraint satisfaction, Game Search, minmax algorithm, alpha beta pruning.

UNIT - III

Logic Concepts and Logic Programming: Introduction, Propositional Calculus Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Table, A System in Propositional Logic, Resolution, Refutation in Propositional Logic, Predicate Logic, Logic Programming.
Knowledge Representation: Introduction, Approaches to knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT - IV

Probabilistic Reasoning: Probability, inference using full joint distributions, Bayes rule, Bayesian networks-representation, construction, exact and approximate inference, temporal model, hidden Markov model. **Markov Decision process:** MDP formulation, utility theory, multi attribute utility functions, decision networks, value iteration, policy iteration and partially observable MDPs.

UNIT - V

Expert System and Applications: Introduction, Phases in Building Expert Systems Expert System Architecture, Expert Systems Vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and tools. **Machine - Learning Paradigms:** Introduction, Machine learning System, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees, Deductive Learning, Clustering.

Text Books:
1. Russell, Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 3nd Edition, 2010.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, First Edition, 2011.

Suggested Reading:
1. Rich, Knight, Nair, "Artificial Intelligence", Tata McGraw Hill, 3rd Edition 2009.
2. Trivedi. M.C., "A classical approach to Artificial Intelligence", Khanna Publishing House, Delhi.

Online Resources:
1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

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18MBC01

ENGINEERING ECONOMICS AND ACCOUNTANCY

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are:
1. To demonstrate the importance of Managerial Economics in decision making.
2. To understand the importance of project evaluation in achieving a firm's objective.
3. To explain the concept of Accountancy and provide basic knowledge on preparation and analyzing of Final accounts.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Apply fundamental knowledge of Managerial economics concepts and tools.
2. Understand various aspects of demand analysis and forecasting
3. Analyze production and cost relationships to make best use of resources available.
4. Analyze different opportunities and come out with best feasible capital investment decisions
5. Apply accountancy concepts and conventions and preparation of final accounts.

UNIT - I

Introduction to Managerial Economics : Introduction to Economics and itsevolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

UNIT II –

Demand and Supply Analysis : Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

UNIT III –

Production and Cost Analysis: Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns; Internal and External Economies of Scale.
Cost Analysis: Cost concepts Types of Costs, Cost-Output Relationship Short Run and Long Run; Market structures Types of Competition, Features, Price Output Determination under Perfect Competition, Monopoly and Monopolistic Competition; Break-even Analysis Concepts, Assumptions, Limitations, Numerical problems.

UNIT IV –

Accountancy: Book-keeping, Principles and Significance of Double Entry Book Keeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments. Ratio Analysis.

UNIT V –

Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical problems.

Text Books:

1. MehtaP.L.,"Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's
2. Educational publishers, 2016.
3. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 11th Edition, 2013. PandayI.M. "Financial Management", 11th edition, Vikas Publishing House, 2015.

Suggested Readings:

1. Varshney and KL Maheswari, "Managerial Economics", Sultan Chand, 2014.
2. M.Kasi Reddy and S.Saraswathi, "Managerial Economics and Financial Accounting", Prentice Hall of India Pvt Ltd, 2007.
3. A.R.Aryasri, "Managerial Economics and Financial Analysis", McGraw-Hill, 2013.

18EEM 01

INDIAN TRADITIONAL KNOWLEDGE

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Credits	0

Course Objectives: The objectives of this course are :

1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand the culture, civilization, and heritage of Ancient, Medieval and Modern India.
2. Distinguish various Languages and Literature existing in India
3. Discuss and Compare Philosophy and Religion in Indian since ancient times
4. Explore various Fine arts in Indian History, and Illustrate the development of Science and Technologyin India.
5. Describe the Indian Education System, and recognize the efforts of scientist to the development ofIndia

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II

Indian Languages, Culture and Literature:

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV

Fine arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT-V

Education system in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”, ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. S. Narain, “Examinations in ancient India”, Arya Book Depot, 1993
4. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
5. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Reading:

1. Kapil Kapoor, “Language, Linguistics and Literature: The Indian Perspective”, ISBN-10: 8171880649, 1994.
2. Karan Singh, “A Treasury of Indian Wisdom: An Anthology of Spiritual Learn”, ISBN: 978-0143426158, 2016.

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18CSC26

DATA COMMUNICATION AND COMPUTER NETWORKS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Pre-requisites: Basics of Operating System, Linux Commands.

Course Objectives: The objectives of this course are

1. To familiarize students with the communication media, devices, and protocols.
2. To expose students to gain practical knowledge of computer networks configuration and monitoring.
3. To create network simple computer networks using simulation tools.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify the different types of equipment like cables used in the networks Lab.
2. Recognize the various network devices like repeater, hub, switch.
3. Practice the basic network commands like ifconfig, ping, traceroute, nslookup, dig, arp, netstat, nmap.
4. Design and demonstrate network topologies using NS3 simulation tool.
5. Examine the packet transfer using NetAnim.
6. Analyze the network performance using Wire shark or any tool.

LIST OF EXPERIMENTS:

1. Study of Network media, cables, and devices and Cable Construction
2. Demonstration of basic network commands/utilities (both in Windows and Linux)
3. PC Network Configuration
4. Building a switch-based network / Configuration of Cisco Catalyst Switch 3560
5. Configuration of Cisco Router 2900
6. Basic OSPF configuration
7. Basic EIGRP Configuration
8. Analysis of network traces using tcpdump
9. Analysis of network traces using Whireshark

Textbooks:

1. S. Tanenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2013.

Online Resources:

1. https://learningnetwork.cisco.com/s/question/0D53i00000Kt7EkCAJ/tools-for-ccnp-network- simulator-lab-tasks
2. https://www.packettracernetwork.com/
3. https://www.ghacks.net/2019/11/13/gns3-is-an-open-source-graphical-network-simulator-for- windows-linux-and-macos/
4. https://www.imedita.com/blog/top-10-list-of-network-simulation-tools/

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18CSC27

CASE STUDY

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Case studies are common in engineering where we analyse (study) situations. Case study exercise is a realistic simulation of a real life situation or strategic problem we are likely to encounter in our workplace or surroundings. A case study is actually "analysing, applying engineering and science knowledge, reasoning and drawing conclusions" to solve a real situation. Case studies are different types including historical, real life, problem oriented etc.

Course Objectives: The objectives of this course are
1. To expose students to real life problems/events/situations and technologies
2. To promote individual study, critical thinking and group discussions to build team work
3. To inculcate the culture of self-learning, professional ethics communication

Course Outcomes: On successful completion of the case study, students will be able to
1. Understand real life situations, problems, developments of technologies in Computer science
2. Interpret, analyse, and think critically about the events, situations and gather information from varioussources for formulating solutions
3. Apply learned knowledge and commit to decisions
4. Evaluate the approach and solution to the event/problem by considering efficiency and optimization
5. Communicate efficiently both in written and orally to discuss the recommendations

Suggestions to select case studies
- For a real situation case study, you can choose an event at your workplace to analyse.
- For a historical case study, you can take a recent collapse/development of a company /technology /project (Cambridge Analytica, Google, Facebook, AI, ML, IoT, GitHub, GNU, LibreOffice, FOSS etc.) and analyse what went wrong or gave raise.
- For a problem oriented case study, choose a problem where they need to (Situation-- Problem-Solution(s)--Evaluation):
  - understand the situation faced (significance),
  - analyse the specific problem to be tackled,
  - create, analyse, and refine a solution and
  - further evaluate, improve and implement

Instructions:
- Students need to choose a case in consultation with any one of their class teachers and mentor
- The topic should be confined to the areas/courses of AI, SE, IoT,
- Submit an abstract consisting of the significance, objectives, methodology and work plan by the end of 3rd week
- Every week they need to show progress to the concerned teacher and mentor
- Shall present/demonstrate and submit a report(read the Case Study guide lines)

Assessment: The main focus of case studies are to assess the approach and the solution arrived. In fact, case studies are usually designed not to have one 'correct' answer. As long as the students justify their recommendation, and stand up to interrogation from the assessor, they are likely to score marks. Students will be monitored by an internal teacher along with their mentors and evaluated by the external examiner at end.

18CSE09

INTERNET OF THINGS
(PROFESSIONAL ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Computer Architecture and Microprocessor, Programming Basics.

Course Objectives: The objectives of this course are
1. Impart necessary and practical knowledge of components of Internet of Things.
2. Understand IoT Protocols.
3. Develop skills required to build real-time IoT based projects.

Course Outcomes: On Successful completion of this course, student will be able to
1. Identify hardware and software components of Internet of Things.
2. Interface Input-Output devices, sensors with Arduino and Raspberry Pi using communication modules.
3. Analyze the use of communication protocols in IoT.
4. Remotely monitor data and subsequently control various devices.
5. Develop real time IoT based projects.
6. Applications of IoT in various domains such as health care, industrial automation.

UNIT - I
Introduction to IoT: Architectural Overview, Design principles and requirements of IoT, IoT Applications. **Elements of IoT:** Basics of networking, sensors, actuators, computing devices, software, data management and processing environment and Security issues.

UNIT - II
IoT Hardware Components: Computing (Arduino, Raspberry Pi), Communication, Sensors, Actuators, I/0 interfaces, Programming API's (for Arduino and Rasp berry Pi).

UNIT - III
IoT Protocols: 6LowPAN,RPL, IPV6, WiFi, ZigBee, Bluetooth, BLE, MQTT, CoAP, RFID.

UNIT - IV
IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

UNIT - V
IoT Case Studies: IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.

Text Books:

1. Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, “Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers, Series in Communications, 2013.

Online Resources / Web links / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, “Internet of Things in Industries: A Survey “, IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik , JP. Vasseur, R. Alexander, “RPL: IPv6 Routing Protocol for Low-Power and Lossy Networks”, IETF, Standards Track, Mar. 2012.

3. Z. Shelby, K. Hartke, C. Bormann, “The Constrained Application Protocol (CoAP)”**,** Internet Engineering Task Force (IETF), Standards Track, 2014.
4. L.Fenzel, “What’s The Difference Between IEEE 802.15.4 And ZigBee Wireless?”, Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, "Information theoretic self-management of Wireless Sensor Networks", Proceedings of NCC 2013.
6. F. Luo et al., "A Distributed Gateway Selection Algorithm for UAV Networks," in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22-33, March 2015.

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18CSE10

PARALLEL AND DISTRIBUTED ALGORITHMS
(PROFESSIONAL ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are
1. To acquaint students with the basic concepts of parallel and distributed computing.
2. To provide knowledge of parallel computing platforms.
3. To learn parallel and distributed algorithms development techniques for shared memory and message passing models.
4. To equip the students with modern parallel and distributed approaches for solving problems in emerging applications.

Course Outcomes: On Successful completion of this course, student will be able to
1. Describe the models and techniques for parallelization.
2. Make use of list ranking and graph coloring parallel Algorithms.
3. Analyze parallel algorithms and compute their complexity measures.
4. Develop parallel programs for search and matrix multiplication using open MP.
5. Choose a parallel algorithm that makes good use of the target Architecture.
6. Describe the distributed Algorithms to learn its models and complexity measures.

UNIT - I
The Idea of Parallelism: A Parallelized version of the Sieve of Eratosthenes. PRAM Model of Parallel Computation. Pointer Jumping and Divide & Conquer: Useful Techniques for Parallelization.

UNIT - II
PRAM Algorithms: Parallel Reduction, Prefix Sums, List Ranking, Preorder Tree Traversal, Merging Two Sorted Lists, Graph Coloring, Reducing the Number of Processors and Brent's Theorem, Dichotomy of Parallel Computing Platforms, Cost of Communication, Programmer's view of modern multi-core processors.

UNIT - III
The role of compilers and writing efficient serial programs, Parallel Complexity: The P-Complete Class, Mapping and Scheduling, Elementary Parallel Algorithms for Sorting.

UNIT - IV
Parallel Programming Languages: Shared Memory Parallel Programming using OpenMP
Writing efficient openMP programs, Dictionary Operations: Parallel Search, Graph, Algorithms and Matrix Multiplication.

UNIT - V
Distributed Algorithms: models and complexity measures. Safety, liveness, termination, logical time and event ordering, Global state and snapshot algorithms, Mutual exclusion and Clock Synchronization, Distributed Graph algorithms.

Text Books:
1. Michael J Quinn, “Parallel Computing: Theory and practice”, Tata McGraw Hill, 1993.
2. Roman Trobec, Boštjan Slivnik, Patricio Bulić, Borut Robič, “Introduction to Parallel Computing”, Springer, 2018.
3. Joseph Jaja, “Introduction to Parallel Algorithms”, First Edition, Addison Wesley, 1992.

Suggested Reading:
1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, “Introduction to Parallel Computing”, Second Edition, Addison Wesley, 2003

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc19_cs17/preview
2. https://nptel.ac.in/courses/106102163/

18CSE11

CLOUD COMPUTING
(PROFESSIONAL ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are:
1. To impart the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they can adopt Cloud Computing services and tools in their real life scenarios.
3. To provide knowledge about security and privacy issues related to cloud computing environments.
4. To enable students explore cloud computing driven commercial systems such as Google App Engine, Microsoft Azure and Amazon Web Services and others

Course Outcomes: On successful of the course student will be able to:
1. Define Cloud Computing and related concepts and describe the characteristics, advantages, risks and challenges associated with cloud computing.
2. Explain and characterize various cloud service models, cloud deployment models.
3. Explore virtualization techniques that serve in offering software, computation and storage Services onthe cloud.
4. Illustrate the concepts of cloud storage and demonstrate their use in storage systems such as AmazonS3 and HDFS.
5. Understand the security and privacy issues related to cloud computing environments.
6. Investigate/Interpret the security and privacy issues related to cloud computing environments.

UNIT - I

Introduction to Cloud Computing: Cloud Computing in a Nutshell, System Models for Distributed and Cloud Computing, Roots of Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, Basic Principles of Cloud Computing, Challenges and Risks, Service Models.

UNIT - II

Virtual Machines and Virtualization of Clusters and Data Centers: Levels of Virtualization, Virtualization Structures//Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization Data-Center Automation. Case studies: Xen Virtual machine monitors- Xen API. VMware - VMware products-Vmware Features. Microsoft Virtual Server - Features of Microsoft Virtual Server.

UNIT - III

Cloud computing architectures over Virtualized Data Centers: Data-Center design and Interconnection networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, GAE, AWS, Azure, Inter-cloud Resource Management.

UNIT - IV

Cloud Security and Trust Management, Data Security in the Cloud : An Introduction to the Idea of Data Security, The Current State of Data Security in the Cloud, CryptDb: Onion Encryption layers-DET,RND,OPE,JOIN,SEARCH, HOM, and Homomorphic Encryption, FPE. Trust, Reputation and Security Management.

UNIT - V

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, parallel and distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments. Common Standards in Cloud Computing: The Open Cloud Consortium, the Distributed Management Task Force, Standards for Application Developers, Standards for Messaging. Internet Messaging Access Protocol (IMAP), Standards for Security, Examples of End-User Access to Cloud Computing.

Text Books:
1. John W. Rittinghouse, "Cloud Computing: Implementation, Management, and Security ". James F. Ransome, CRC Press 2009.
2. Kai Hwang. Geoffrey C.Fox, Jack J. Dongarra, "Distributed and Cloud Computing From Parallel Processing to the Internet of Things", Elsevier, 2012.
3. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski," Cloud Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing), Wiley Publishing ©2011.

Suggested Reading:

1. Raluca Ada Popa, Catherine M.S. Redfield, Nickolai Zeldovich, and Hari Balakrishnan, “CryptDB: Protecting Confidentiality with encrypted Query Processing”, 23rd ACM Symposium on Operating Systems Principles (SOSP 2011), Cascais, Portugal October 2011.
2. A Fully Homomorhic Encryption Scheme, Craig Gentry, September 2009.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

Online Resources:

1. http://aws.amazon.com
2. http://code.google.com/appsengine
3. http://www.buyya.com/

18CSE12

COMPUTER VISION
(PROFESSIONAL ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Linear Algebra and Probability, Digital Image Processing.

Course Objectives: The objectives of this course are
1. To understand the Fundamental Concepts Related To Multi-Dimensional Signal Processing.
2. To understand Feature Extraction algorithms.
3. To understand Visual Geometric Modeling and Stochastic Optimization.

Course Outcomes: On Successful completion of this course, student will be able to
1. Recognize the basic fundamentals of vision and describe the scope of challenges.
2. Develop algorithms to analyze feature detection and feature alignment.
3. Analyze images and videos for problems such as tracking and structure from motion.
4. Choose object, scene recognition and categorization algorithms for real time images.
5. Explain recovery of 3D structure of ill-posed scenes.
6. Apply various techniques to build computer vision applications.

UNIT - I

Introduction to Computer Vision and Image Formation: Introduction, Geometric primitives and transformations, Photometric image formation, Digital Camera image formation. **Image Processing:** Point operators, Linear filtering, More neighborhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations.

UNIT - II

Feature detection and matching: Points and patches, Edges, Lines. **Segmentation**: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts. **Feature-based alignment**: 2D and 3D feature-based alignment, Pose estimation.

UNIT - III

Structure from motion: Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, Constrained structure and motion. **Dense motion estimation:** Translational alignment, Parametric motion, Spline-based motion, Optical flow, Layered motion.

UNIT - IV

Recognition: Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding.

UNIT - V

3D Reconstruction: Shape from X, Active range finding, Surface representations, Point-based representations, volumetric representations, Model-based reconstruction, Recovering texture maps.

Text Books:

1. Richard Szeliski "Computer Vision: Algorithms and Applications", Springer-Verlag London Limited, 2011.
2. R. C. Gonzalez and R. E. Woods, "Digital Image Processing"; Addison Wesley, 2008.

Suggested Reading:

1. Robert J. Schallkoff, "Pattern Recognition: Statistical. Structural and Neural Approaches", John Wiley and Sons; 1992+.
2. D. A. Forsyth and J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
3. R. Hartley and A. Zisserman, "Multiple View geometry", Cambridge university Press, 2002.
4. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.
5. K. Fukunaga; "Introduction to Statistical Pattern Recognition", Second Edition, Academic Press, Morgan Kaufmann, 1990.

Online Resources:
1. CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline
2. Computer Vision Homepage: http://www2.cs.cmu.edu/afs/cs/project/cil/ftp/html/vision.html

Professor and Head Department

18CSE13

SOFT COMPUTING
(PROFESSIONAL ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Fundamental Mathematics.

Course Objectives: The objectives of this course are
1. To learn various types of soft computing techniques and their applications.
2. To acquire the knowledge of neural network architectures, learning methods and algorithms.
3. To understand Fuzzy logic, Genetic algorithms and their applications.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand various soft computing techniques.
2. Analyze and design various learning models and Neural Network Architectures.
3. Apply the Neural Network Architecture for various Real time applications.
4. Understand approximate reasoning using fuzzy logic.
5. Analyze and design Genetic algorithms in different applications.
6. Apply soft computing techniques to solve different applications.

UNIT - I

Soft computing vs. Hard computing, Various types of soft computing techniques.

Artificial Neural Networks: Fundamental concepts, Evolution of neural networks, Basic models of artificial neural network, important terminologies of ANNs. McCulloch-Pitts neuron, linear separability, Hebb network.

UNIT - II

Supervised Learning Neural Networks: Perceptron networks, Adaptive linear neuron (Adaline), Multiple Adaptive linear neuron (Madaline), Back propagation network.

UNIT - III

Unsupervised Learning Neural Networks: Kohonen Self Organizing networks, Adaptive resonance theory. **Associate Memory Networks:** Bidirectional associative memory network, Hopfield networks.

UNIT - IV

Fuzzy Logic: Introduction to classical sets and Fuzzy sets, Fuzzy relations, Tolerance and equivalence relations, Membership functions, Defuzzification.

UNIT - V

Genetic Algorithms: Introduction, Basic operators and terminology, Traditional algorithm vs. genetic algorithm, Simple genetic algorithm, General genetic algorithm, Classification of genetic algorithm, Genetic programming, Applications of genetic algorithm.

Text Books:

1. S.N. Sivanandam& S.N. Deepa, “Principles of soft computing”, Wiley publications, 2nd Edition, 2011.

Suggested Reading:

1. S. Rajasekaran& G.A. Vijayalakshmipai, “Neural Networks, Fuzzy logic & Genetic Algorithms, Synthesis & Applications”, PHI publication, 2008.
2. LiMin Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill edition, 1994.
3. K.L.Du& M.N.S Swamy, “Neural Networks in a Soft Computing Framework”, Springer International edition, 2008.
4. Simon Haykins, “Neural Networks a Comprehensive Foundation”, PHI, second edition.
5. Goldberg, David E., “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, New Delhi, 2002.
6. N.P. Padhy and S.P. Simon, ”Soft Computing: With Matlab Programming”, Oxford University Press, 2015.

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc18_cs13/preview.

Professor and Head Department

18CSE14

NETWORK AND SYSTEM ADMINISTRATION
(PROFESSIONAL ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System Concepts, Data Communications and Computer networks

Course Objectives: The objectives of this course are
1. To study about the operation of computers, servers and the networking
2. Familiarize the students with system and network administration tools.
3. Prepare the students to analyze the performance of system and network to resolve the issues

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify and define the the basic system administration and networking tools
2. Illustrate system boot process, administration tools
3. Configure various services like mail, ftp, web hosting, security, use remote administration tools
4. Analyze and interpret log messages for troubleshooting the issues
5. Measure and evaluate the performance of system and network,
6. Write scripts to automate system administration process

UNIT - I

Networking Overview: History, Protocol Standards, Reference Models (ISO-OSI, TCP/IP), Windows and Linux networking basics, switching and routing basics.

Server Administration Basics: Server and Client Installation, Boot Process and Startup Services: Xinetd, Managing accounts: users, groups and other privileges, File Systems and Quota Management , Job Scheduling with cron, crontab, anacron and system log analysis, Process controlling and management, Online Server upgrade/update process.

UNIT - II

Network Configuration Basics: IPv4 and IPv6 addressing, Network Interface Configuration, Diagnosing Network startup issues, Linux and Microsoft, Firewall configuration, Network troubleshooting commands. **Dynamic Host Configuration Protocol (DHCP),** DHCP Principle, DHCP Server Configuration DHCP Options, Scope, Reservation and Relaying, DHCP Troubleshooting.

UNIT - III

Name Server and Configuration: DNS principles and Operations, Basic Name Server and Client Configuration, Caching Only name server, Primary and Slave Name Server, DNS Zone Transfers, dynamic Updates, delegation, DNS Server Security, troubleshooting.

Web and Proxy Server Configuration: HTTP Server Configuration Basics, Virtual Hosting, HTTP Caching, Proxy Caching Server Configuration, Proxy ACL, Proxy-Authentication Mechanisms, Troubleshooting.

UNIT - IV

FTP, File and Print Server: General Samba Configuration, SAMBA SWAT, NFS and NFS Client Configuration, CUPS configuration basics, FTP Principles, Anonymous FTP Server, Troubleshooting.

Mail Server basics: SMTP, POP and IMAP principles, SMTP Relaying Principles, Mail Domain Administration, Basic Mail Server Configuration, SPAM control and Filtering.

UNIT - V

Remote Administration and Management: Router Configuration, Webmin/ usermin, Team Viewer, Telnet, SSH, SCP, Rsync.

Text Books / Suggested Reading:

1. Thomas A. Limoncelli, Christina J. Hogan , Strata R. Chalup, “The Practice of System and Network Administration”, Pearson Education, Second Edition, 2012
2. Roderick W. Smith, “Advanced Linux Networking, Addison”, Wesley Professional (Pearson Education), 2002.
3. Tony Bautts, Terry Dawson, Gregor N. Purdy, “Linux Network Administrator’s Guide”, O’Reilly Publisher, Third Edition, 2005

Suggested readings:

1. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, "UNIX and Linux System Administration Handbook", Fifth Edition, 2017, Addison Wesley

Online resource:

1. https://study-ccna.com/
2. https://www.edx.org/course/it-support-networking-essentials

Professor and Head Department

18CSE15

MOBILE COMPUTING
(PROFESSIONAL ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are:
1. Understand the concepts of mobile computing
2. Study network layer and transport layer protocols and Ad-Hoc networks.
3. Discuss about mobile platforms and application development.

Course Outcomes: On Successful completion of this course, student will be able to
1. Explain the basics of mobile telecommunication systems
2. Illustrate the generations of telecommunication systems in wireless networks
3. Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network
4. Explain the functionality of Transport and Application layers
5. Develop a mobile application using android/blackberry/ios/Windows SDK

UNIT-I

Introduction: Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA.

UNIT-II

Mobile Telecommunication System: Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security.

UNIT-III

Mobile Network Layer: Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.

UNIT-IV

Mobile Transport And Application Layer: Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

UNIT-V

Mobile Platforms And Applications: Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

Text Books:

1. Jochen Schiller, “Mobile Communications”, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi – 2012
3. Rajkamal, “Mobile Computing”, University press publications, 2014.

Suggested Reading :

1. Dharma Prakash Agarval, Qing and An Zeng, “Introduction to Wireless and Mobile systems”, Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
3. William.C.Y.Lee, “Mobile Cellular Telecommunications-Analog and Digital Systems”, Second Edition,TataMcGraw Hill Edition ,2006.
4. C.K.Toh, “AdHoc Mobile Wireless Networks”, First Edition, Pearson Education, 2002.

Online Resources :
1. Android Developers : http://developer.android.com/index.html
2. Apple Developer : https://developer.apple.com/
3. Windows Phone DevCenter : http://developer.windowsphone.com
4. BlackBerry Developer : http://developer.blackberry.com

18CSE16

FREE AND OPEN SOURCE SOFTWARE (FOSS)
(PROFESSIONAL ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of this course are:

1. Familiarize the students with Open Source Technologies.
2. Expose students with OSS Projects, Advantages of Open Source.
3. Make the students understand the principles, methodologies, policies, licensing procedures and ethicsof FOSS.

Course Outcomes: On Successful completion of this course, student will be able to:

1. Identify various FOSS tools, platforms, licensing procedures and development models, ethics
2. Describe various FOSS projects, development models and project management
3. Adapt to the usage of FOSS tools and technologies.
4. Distinguish between Proprietary and Open Source tools, development methods
5. Evaluate various Open Source projects like Linux, Apache, GIT
6. Practice Open Source principles, ethics and models.

UNIT - I

Introduction to Open Source: Open Source, need and principles of OSS, Open Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT – II

Fault Tolerant Design: **Principles and Open Source Methodology**- History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT – III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, LibreOffice.

UNIT – IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media

What Is A License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT – V

Open Source Ethics- Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:

1. Kailash Vadera, Bhavyesh Gandhi “Open Source Technology”, University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, “Open Source Technology and Policy”, Cambridge University Press.

Suggested Reading:

1. Wale Soyinka, “Linux Administration- A beginner’s Guide”, Tata McGraw Hills.
2. Andrew M. St. Laurent, “Understanding Open Source and Free Software Licensing”, O'Reilly Media.
3. Dan Woods, Gautam Guliani, “Open Source for the Enterprise”, O'Reilly Media.
4. Bernard Golden, “Succeeding with Open Source”, Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, “Perspectives on Free and Open Source Software”, MIT press.

Online Resources:

1. https://fossee.in/
2. https://opensource.com
3. https://www.gnu.org/

Choice Based Credit System (CBCS)

Name of the Programme (UG):

B.E Syllabus for Semester VII and VIII - Semester

With effect from 2019 - 2020

Specialization /Branch: Computer Science and Engineering

Chaitanya Bharathi Institute of Technology (A)
Chaitanya Bharathi (P.O), Gandipet
Hyderabad-500075, Telangana State.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTION AND EXAMINATION
VII-Semester of B.E under CBCS
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-VII

Sl.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16CSC 33	Data Science and Big Data Analytics	3	-	3	30	70	3
2	16CSC 34	Free and Open Source Software	3	-	3	30	70	3
3	16CSC 35	Distributed and Cloud Computing	3	-	3	30	70	3
4	16CSC 36	Machine Learning	3/1	-	3	30	70	4
5		Elective-IV	3	-	3	30	70	3
6		Elective-V	3	-	3	30	70	3
PRACTICALS								
7	16CSC 37	DSBDA Lab	-	3	3	25	50	2
8	16CSC 38	ML Lab	-	3	3	25	50	2
9	16CSC 39	Project Seminar	-	3	3	50	-	2
TOTAL			**19**	**9**		**280**	**520**	**25**

ELECTIVE-IV	
16CSE 10	Deep Learning
16CSE 11	Design Patterns
16CSE 12	Nature Inspired Algorithm
16CSE 13	System and Network Administration

ELECTIVE-V (OE1)	
16CEO 02	Disaster Mitigation and Management
16MEO 01	Entrepreneurship
16MEO 06	Research Methodologies
16EGO 02	Gender Sensitization

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

NPTEL Courses (Enrollment :15-05-2019 to 29-07-2019)				
Exam Registration (Open and Close Dates) : 1-Jun-19 to 23-09-2019 10.00 am				
Courses	**Elective**	**Course Start Date**	**Course End Date**	**Exam Date**
Software Project Management	Elective - IV	29-07-2019	18-10-2019	02-11-2019
Ethical Hacking		29-07-2019	18-10-2019	02-11-2019
Natural Language Processing		29-07-2019	18-10-2019	02-11-2019
Block Chain Architecture Design and Use cases	Elective - V	29-07-2019	18-10-2019	03-11-2019
Social Networks		29-07-2019	18-10-2019	02-11-2019
Computer Vision		29-07-2019	18-10-2019	02-11-2019

Professor and Head Department
Department of Computer Science & Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075 (T.S.)

Assessment Procedure				
Course (in terms of credits)	**Continuous Internal Evaluation (Marks)**	**Semester end Examination (Marks)**	**Remarks**	**Duration of Semester End Examination**
Three(3)Credits/ Four(4)credits	30*	70**	Theory Course/ Engg . Graphics	3 Hours
Two(2) Credits	25	50	Lab Course/Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
One(1) Credit	50	-	Mini Project	-

* Out of 30 CIE, 10 marks are allotted for slip-tests (Three slip tests will be conducted, each of ten marks, and average of best two is considered) and the remaining 20 marks are based on the average of two tests, weightage for each test is 20 marks.

** The question paper will be in two parts, Part-A and Part-B. Part A is compulsory and contains short answer questions covering the entire syllabus, and carries 20 marks. Part-B carries 50 marks and covers all the units of the syllabus (student has to answer five out of seven questions).

Note: A course that has CIE but no SEE as per scheme is treated as PASS/FAIL for which pass marks are **50%** of CIE.

A candidate has earned the credits of a particular course, if he/she secures not less than the minimum marks/ grade as prescribed. Minimum pass marks in the SEE plus CIE shall be 40% for theory courses/subjects and **50%** for lab courses /Mini Project/ Project.

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16CSC 33

DATA SCIENCE AND BIG DATA ANALYTICS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre Requisites: DBMS, Probability and Statistics

Course Objectives: The main objectives of this course are:
1. Introduce a data analytics problem solving framework
2. Develop technical skills in probability modeling and statistical inference for the practical application of statistical methods.
3. Use existing and develop new statistical tools for data science problems across different applied domains.

Course Outcomes: On successful of this course student will be able to:
1. Understands various phases of the data analytics life cycle.
2. Apply statistical methods to data for inferences.
3. Analyze data using Classification, Graphical and computational methods.
4. Understands Big Data technologies and NOSQL.
5. Analyze various types of data using Data Analytics Techniques.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	-	-	-	1	-	-	-	-	-	-	1	-
2	3	1	2	2	2	1	-	-	2	1	1	2	1	2
3	3	3	2	3	3	-	-	-	2	1	-	3	3	3
4	3	-	-	-	3	-	-	-	-	-	-	-	2	3
5	3	3	2	2	3	-	-	-	-	-	1	2	3	3

UNIT - I

Data Analytics Life cycle: Data Analytics Life cycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalise, Exploratory Data Analysis, Statistical Methods for Evaluation, ANOVA.

UNIT - II

Overview of Supervised Learning: Variable Types and Terminology, Two Simple Approaches to Prediction: Least Squares and Nearest Neighbors, Model Selection and Bias–Variance Tradeoff. **Association Analysis:** Association rules, Apriori algorithm, FP-Growth Technique

UNIT - III

Time Series Analysis: Overview of Time Series Analysis, ARIMA Model; **Text Analysis:** Text Analysis Steps, Stop Word Removal, Tokenization, Stemming and Lemmatization, Representing Text: Term-Document Matrix, Term Frequency--Inverse Document Frequency (TFIDF).

UNIT - IV

Introduction to Big Data: Defining big data, 4 V's of big data, Big data types, Analytics, Examples of big data, Big data and Data Risk, Big data technologies, benefits of big data, Crowd sourcing analytics; **Hadoop Distributed File Systems:** Architecture of Apache Hadoop HDFS and other File Systems, HDFS File Blocks, HDFS File Commands

UNIT - V

NoSQL Data Management: Types of NOSQL data bases, Benefits of NO SQL, **Map Reduce:** Introduction, Map reduce example, Job Tracker, Map Operations. **Data Stream Mining:** The stream data model, streaming applications, continuous query processing and optimization, Distributed query processing.

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Gandipet, Hyderabad-500 075 (T.S.)

Text Books:

1. EMC Education Services "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publishers, 2012.
2. Hastie, Trevor, et al., "The elements of statistical learning: Data Mining, Inference, and Prediction", Vol. 2. No. 1. New York: Springer, 2009.
3. V.K. Jain,"Big Data & Hadoop", Khanna Publishing House,2017.

Suggested Reading:

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012
2. Mark Gardener, "Beginning R The statistical Programming Language", Wiley, 2015.
3. Han, Kamber, and J Pei, "Data Mining Concepts and Techniques", 3rd edition, Morgan Kaufman, 2012.
4. Big Data Black Book, DT Editorial Services, Wiley India
5. V.K. Jain, "Data Science & Analytics", Khanna Publishing House Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, ISBN: 978-93-86173454.
6. Montgomery, Douglas C., and George C. Runger John, "Applied statistics and probability for engineers", Wiley & Sons, 6th edition, 2013.

16CSC 34 FREE AND OPEN SOURCE SOFTWARE

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Familiarity with Open Source Technologies
2. Study some FOSS Projects to under the principles, methodologies of FOSS.
3. Understand the policies, licensing procedures and ethics of FOSS.

Course Outcomes: On successful of this course student will be able to:
1. Differentiate between Open Source and Proprietary software and Licensing.
2. Recognize the applications, benefits and features of Open Source Technologies.
3. Understand and demonstrate Version Control System along with its commands.
4. Gain knowledge to start, manage open source projects.
5. Understand and practice the Open Source Ethics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	2	2	2	-	-	-	2	1	1	1	3
2	2	2	3	3	2	2	1	1	1	1	2	2	1	3
3	3	3	3	3	3	3	1	-	2	2	3	1	2	3
4	3	3	3	2	3	3	2	2	2	3	2	3	1	3
5	3	3	2	2	2	2	2	3	1	2	2	2	1	3

UNIT - I

Introduction to Open Source: Open Source, need and principles of OSS, Open Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT - II

Fault Tolerant Design: **Principles and Open Source Methodology**- History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT - III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, Libre Office.

UNIT - IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media

What Is A License, Creation of our own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT - V

Open Source Ethics: Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:
1. Kailash Vadera, Bhavyesh Gandhi, "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press, 2008

Suggested Reading:
1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills, 2009
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media, 2004.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media, 2005.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional,2004.
5. Clay Shirky and Michael Cusumano, "Perspectives on Free and Open Source Software", MIT press, 2005.

16CSC 35 DISTRIBUTED AND CLOUD COMPUTING

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To present the principles underlying the function of distributed computing
2. To understand key mechanisms of remote execution
3. To impart the fundamentals and essentials of Cloud Computing.
4. To enable students explore cloud computing driven real time systems

Course Outcomes: On successful of this course student will be able to:
1. Understand the characteristics and models in distributed computing.
2. Define Cloud Computing and related concepts and describe the characteristics, advantages, risks and challenges associated with cloud computing.
3. Explain and characterize various cloud services and deployment models, virtualization techniques.
4. Illustrate the concepts of cloud storage and demonstrate their use.
5. Analyze various cloud programming models and apply them to solve problems

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	1	2	1	-	-	-	-	-	-	-	-
2	3	3	2	1	1	1	-	-	-	-	-	-	-	-
3	3	2	3	2	1	1	-	-	-	-	-	-	-	-
4	3	3	2	1	1	1	-	-	-	-	-	-	-	-
5	3	3	3	2	1	1	-	-	-	-	-	-	-	-

UNIT - I

Characterization of Distributed Systems: Introduction, Examples of distributed systems, Resource sharing and the web, Challenges, **System Models:** Introduction, Architectural models, Fundamental models, **Interprocess Communication:** Introduction, The API for the internet protocols, External data representation and marshalling, Client server communication, Group communication, Interprocess communication in UNIX

UNIT - II

Distributed objects and Remote Invocation: Introduction, Communication between distributed objects, Remote procedure call, Events and notifications, **Time and Global States:** Introduction, Clocks, events and process states, Synchronizing physical clocks, Logical time and logical clocks, Global states, distributed debugging, **Coordination and Agreement:** Introduction, Distributed mutual exclusion, Elections, Multicast communication, Consensus and related problems.

UNIT - III

Introduction to Cloud Computing: Scalable Computing Over the Internet, System Models for Distributed and Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, **Virtual Machines and Virtualization of Clusters and Data Centers:** Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.

UNIT - IV

Cloud computing architecture over Virtualized Data Centers: Data-Center design and Interconnection networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, GAE, AWS, Azure, Inter-cloud Resource Management.

UNIT - V

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, **Common Standards in Cloud Computing:** The Open Cloud Consortium, the Distributed Management Task Force, Standards for Messaging, Internet Messaging Access Protocol (IMAP)

Text Books:

1. Colouris, Dollimore, Kindberg, “Distributed Systems concepts and Design”,5th Ed. Pearson Education, 2016.
2. Kai Hwang. Geoffrey C.Fox, Jack J. Dongarra, “Distributed and Cloud Computing From Parallel Processing to the Internet of Things”, Elsevier, 2012.

Suggested Readings:

1. Sunita Mahajan and Seema Shah,"Distributed Computing", Oxford University Press, 2013.
2. S.Ghosh, Chapman and Hall/CRC, ”Distributed Systems”, Taylor & Francis Group, 2010.
3. Pradeep K.Sinha, “Distributed Operating Systems Concepts and Design”, PHI,
4. Andrew S. Tanenbaum, Van Steen, “Distributed Systems”, Pearson Education, 2002.

16CSC 36 **MACHINE LEARNING**

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Pre-requisites: Linear Algebra and Probability theory basics

Course Objectives: The main objectives of this course are:
1. Understand the need and elements of Machine Learning
2. Study various machine learning techniques
3. Design solutions for real world problems using machine learning techniques

Course Outcomes: On successful of this course student will be able to:
1. Define the basic concepts related to Machine Learning
2. Recognize the underlying mathematical relationships within and across Machine Learning algorithms and their paradigms
3. Determine the various applications of machine learning
4. Model the problems using various machine learning techniques
5. Design and develop solutions to real world problems using Machine Learning Algorithms
6. Evaluate and interpret the results of the various machine learning techniques

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	3	-	-	-	-	-	-	-	3	3	2
2	3	3	1	3	-	-	-	-	-	-	-	3	3	2
3	3	3	1	3	-	-	-	-	-	-	-	3	3	2
4	3	3	1	3	-	-	-	-	-	-	-	3	3	2
5	3	3	1	3	3	-	-	-	-	-	-	3	3	2
6	3	3	1	3	3	-	-	-	-	-	-	3	3	2

UNIT - I

Introduction to Machine Learning: Introduction, Classic and Adaptive machines, learning types, deep learning, bio-inspired adaptive systems, Machine Learning and big data; **Elements of Machine Learning:** Data formats, Learnability, Statistical learning concepts, Class balancing, Elements of Information theory

UNIT - II

Feature Selection and Feature Engineering: Data sets, Creating training and test sets, managing categorical data, missing features, data scaling and normalization, Withering, Feature selection and filtering, PCA, Visualization of high-dimensional datasets; **Regression Algorithms**: Linear models for regression, Regression types, **Linear Classification Algorithms:** Linear classification, logistic regression, grid search, classification metrics, ROC curve

UNIT - III

Naïve Bayes and Discriminant Analysis: Bayes theorem, Naïve Bayes classifiers, Discriminant analysis; **Support Vector Machines**: Linear SVM, Kernel-based classification; **Decision Trees and Ensemble Learning**: Binary Decision trees, Introduction to Ensemble Learning-Random Forests, AdaBoost, Gradient Tree Boosting, Voting classifier

UNIT - IV

Clustering Fundamentals: Basics, k-NN, Gaussian mixture, K-means, Evaluation methods, DBSCAN, Spectral Clustering, Hierarchical Clustering; **Introduction to Neural Networks**: Introduction to deep learning, MLPs with Keras, deep learning model layers, introduction to Tensorflow

UNIT - V

Machine Learning Architectures: Data collection, Normalization and regularization, Dimensionality reduction, Data augmentation, Modeling/Grid Search/Cross-validation, Visualization, GPU support, introduction to distributed architectures, Scikit-learn tools for ML architectures, pipelines, Feature unions

Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2nd Edition, Packt, 2018,
2. Tom Mitchel “Machine Learning”, Tata McGraW Hill, 2017

Suggested Reading:

1. Abhishek Vijavargia “Machine Learning using Python”, BPB Publications, 1st Edition, 2018
2. Reema Thareja “Python Programming”, Oxford Press, 2017
3. Yuxi Liu, “Python Machine Learning by Example”, 2nd Edition, PACT, 2017

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.htm
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.geeksforgeeks.org/machine-learning/

16CSC 37 **DATA SCIENCE AND BIG DATA ANALYTICS LAB**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The main objectives of this course are:
1. To introduce practical exposure on basic data science techniques.
2. To develop the skills in using data science tools for solving data intensive problems.
3. To explore the fundamental concepts of big data analytics.

Course Outcomes: On successful of this course student will be able to:
1. Implement and apply data science algorithms to solve problems
2. Implement various the exploratory data analysis techniques to understand the data.
3. Work with big data platform and explore the big data analytics techniques business applications.
4. Design efficient algorithms for analyzing the data from large volumes.
5. Analyze the HADOOP and Map Reduce technologies associated with big data analytics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	2	2	2	1	-	-	2	1	1	2	1	2
2	3	1	2	2	2	1	-	-	2	1	1	2	1	2
3	3	1	1	-	-	2	-	-	-	-	-	1	-	-
4	3	3	2	2	3	-	-	-	-	-	1	2	3	3
5	3	3	2	2	3	-	-	-	-	-	1	2	3	3

List of Experiments:
1. Identification and Installation of required softwares/Technologies (Python/modules)
2. Important modules for statistical methods: Numpy, Scipy, Pandas etc.
3. Demonstration of Inferential Statistics-sampling, Hypothesis testing-Z/t tests
4. Demonstration of statistical methods Anova, Correlation and Chi-square
5. Important modules for Machine Learning: (ScikitLearn, Statsmodels, SciPy, NLTK etc.)
6. Demonstration of Sentiment analysis using NLTK
7. Time Series Forecasting with ARIMA model
8. Installation of Big data technologies and building a Hadoop cluster
9. Experiment for data loading from local machine to Hadoop
10. Demonstration of Map Reduce concept
11. Experiment for loading data from RDBMS to HDFS by using SQOOP
12. Demonstration of developing and handling a NOSQL database with HBase

Text Books:
1. Tom White, “Hadoop: The Definitive Guide: Storage and Analysis at Internet Scale”, 4th Edition, O'Reilly Publications, 2015.
2. Samir Madhavan, “Mastering Python for Data Science”, Packt Publishing, 2015.
3. Seema Acharya, Subhasinin Chellappan, “Big Data and Analytics”, Wiley publications.
4. Big Data, Black Book TM , Dream Tech Press, 2015 Edition

16CSC 38 MACHINE LEARNING LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The main objectives of this course are:

1. Make use of Data sets in implementing the machine learning algorithms.
2. Implement the machine learning concepts and algorithms in any suitable language of choice.
3. Make use of real world data to implement machine learning models.

Course Outcomes: On Successful completion of this course, student will be able to:

1. Understand complexity of Machine Learning algorithms and their limitations.
2. Identify and understand modern tools that are useful in data analysis
3. Implement analyze Machine Learning algorithms
4. Use Keras and Tensorflow packages to implement the solutions
5. Design and develop solutions to real world problems using ML techniques
6. Evaluate and interpret the results of the various machine learning techniques

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	2	-	-	-	-	-	-	-	1	2	2
2	3	2	-	3	2	-	-	-	-	-	-	2	2	2
3	3	3	1	3	2	-	-	-	-	-	-	2	3	3
4	3	3	1	3	3	-	-	-	-	-	-	2	3	3
5	3	3	1	3	3	-	-	-	-	-	-	2	3	3
6	3	3	3	3	3	-	-	-	-	-	-	2	3	3

LIST OF EXPERIMENTS:

1. Identification and Installation of python environment towards the machine learning, installing python modules/Packages Import Scikitlearn, Keras and Tensorflows etc.
2. Demonstration of decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a News sample.
3. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate datasets.
4. Demonstration of Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
5. Demonstration of Bayesian network by considering standard dataset, by using Java/Python ML library classes/API.
6. Demonstration of Clustering algorithms - k-Means, K-Nearest Neighbor a, Agglomerative and DBSCAN to classify for the standard datasets. Print both correct and wrong predictions using Java/Python ML library classes can be used for this problem.
7. Experiment the non-parametric locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graph
8. Demonstration of SVM and use for character recognition task..
9. Build the decision tree classifier compare its performance with ensemble techniques like random forest. Demonstrate it with different decision trees.
10. Experiments on mobile Robots
11. Line, path following
12. Autonomous distance traversing
13. Autonomous distance traversing using GPS
14. Miniature self-driving car using machine learning

Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2017, Packt Publishing.

16CSC 39 PROJECT SEMINARS

Instruction	3 Hours per week
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

Course Outcomes:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a Department Review Committee.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	--	--	--	2	--	--	--	--	--	2	2	2
2	2	--	--	--	--	2	--	--	--	--	--	2	3	3
3	2	--	--	--	--	--	--	2	--	2	--	--	--	--
4	--	--	--	--	1	--	--	2	--	3	--	--	--	--
5	--	--	--	--	1	--	--	2	--	3	--	--	--	--

Guidelines for the award of Marks: **(Max. Marks: 50)**

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Review Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

Professor and Head Department
Department of Computer Science & Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075 (T.S.)

16CSE 10 **DEEP LEARNING (ELECTIVE-IV)**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To learn Deep learning techniques and their applications.
2. To acquire the knowledge of neural network architectures, Deep learning methods and algorithms.
3. To understand CNN and RNN algorithms and their applications.

Course Outcomes: On successful of this course student will be able to:

1. Understand various learning models.
2. Design and develop various Neural Network Architectures.
3. Understand approximate reasoning using Convolution Neural Networks.
4. Analyze and design Deep learning algorithms in different applications.
5. Ability to apply CNN and RNN techniques to solve different applications.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	-	-	-	-	-	-	1	-	-	-	-
2	1	1	2	2	2	-	-	-	-	-	-	-	2	3
3	3	1	1	2	-	-	-	-	-	1	-	-	2	2
4	-	2	1	-	-	-	-	-	-	1	-	1	3	3
5	1	2	1	-	-	-	-	-	-	-	-	1	2	2

UNIT - I

Introduction: Historical Trends in Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm. Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feed forward Neural Networks, Representation Power of Feed forward Neural Networks

UNIT - II

Feed Forward Neural Networks, Back propagation, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMS Prop, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis Principal Component Analysis and its interpretations, Singular Value Decomposition

UNIT - III

Auto encoders : relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Contractive auto encoders, **Regularization:** Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization

UNIT - IV

Convolutional Neural Network: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types. LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Back propagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks

UNIT – V

Recurrent Neural Networks, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs, Encoder Decoder Models, Attention Mechanism, Attention over images

Text Books:

1. Goodfellow. I., Bengio. Y. and Courville. A., “Deep Learning”, MIT Press, 2016.

Suggested Reading:

1. Tom M. Mitchell, "Machine Learning", MacGraw Hill, 1997.
2. Stephen Marsland, "Machine Learning - An Algorithmic Perspective ", CRC Press, 2009.
3. LiMin Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill edition, 1994.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_cs41/

16CSE 11 DESIGN PATTERNS (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To understand the fundamental concepts of C++ and the design patterns,
2. User interfaces, standards of designing a document editor.
3. To understand the Structural Patterns, and the Behavioral pattern.
4. To learn about the dynamics of the design patterns.

Course Outcomes: On successful of this course student will be able to:

1. Apply formal notations of C++, design and develop pattern of user choice and accomplish UI and design an efficient editor.
2. Determine the prototypes, abstract factory to design and develop catalog pattern.
3. Apply the behavioral modeling principles design the behavioral pattern for a system.
4. Use design patterns for real world situations.
5. List consequences of applying each pattern.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	3	2	2	3	3	3	3	3	2	3
2	3	3	3	3	3	2	2	2	2	3	3	3	2	2
3	3	2	3	3	2	2	3	3	3	3	3	3	3	3
4	3	3	3	3	3	3	2	3	3	2	3	3	3	3
5	3	2	2	2	2	3	2	3	3	2	3	3	2	2

UNIT - I

Review of Formal Notations and Foundation Classes in C++: Class Diagram, Object Diagram, Interaction Diagram Examples, List, Iterator, List Iterator, Point, Rect, Coding in C++. **Introduction to Design Patterns:** Design Pattern Definition, Design Patterns in Small Talk MVC, Describing Design Patterns, Catalog of Design Patterns, Organizing The Catalog, Solving of Design Problems Using Design Patterns, Selection of A Design Pattern, Use of Design Patterns.

UNIT - II

Designing a Document Editor: A Case Study: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look and Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation.

UNIT - III

Design Patterns Catalog: Creational Patterns, Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

Structural Patterns-1: Adapter, Bridge, Composite, Decorator. Structural Patterns-2 and Behavioral Patterns-1: Structural Patterns: Façade, Flyweight, Proxy, Discuss of Structural Patterns.

UNIT - IV

Behavioral Patterns: Chain of Responsibility Command, Interpreter. **Behavioral Patterns-2:**Iterator, Mediator, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns.

UNIT - V

Behavioral Patterns-3: State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns, Expectations from Design Patterns.

Text Books:

1. Gamma, Belm, Johnson, "Design Patterns: Elements of Reusable Object Oriented Software", 1995, Pearson Education ISBN:10:0201633612.
2. Eric Freeman, "Head First Design Patterns", Oreilly-SPD,ISBN:10:0596007124.

Suggested Reading:

1. Cooper, "Java Design Patterns", Pearson Education, ISBN:6201-48539-7.
2. Horstmann, "Object Oriented Design and Patterns", Wiley, ISBN:10:0471744875.

Online Resources:

1. shop.oreilly.com/product/9780596007126.do
2. ww.amazon.com/Design-Patterns-Elements.../dp/0201633612

16CSE 12 NATURE INSPIRED ALGORITHM (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Design and Analysis of Algorithms

Course Objectives: The main objectives of this course are:
1. Understand the fundamentals of nature inspired techniques which influence computing
2. Study the Swarm Intelligence and Immuno computing techniques
3. Familiarize the DNA Computing

Course Outcomes: On successful of this course student will be able to:
1. Understand The basics Natural systems
2. Learn the concepts of Natural systems and its applications
3. Understand different basic Natural systems functions(operations)
4. Understand Natural design considerations
5. Apply to real world problems

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	-	3	-	-	-	-	-	-	--	-	-	-	-
4	-	3	3	-	-	-	-	-	-	-	-	-	2	-
5	-	3	2	-	-	-	-	-	-	-	--	-	2	-

UNIT - I

Introduction: From Nature to Nature Computing , Philosophy , Three Branches: A Brief Overview, Individuals, Entities and agents - Parallelism and Distributivity Interactivity ,Adaptation- Feedback-Self-Organization-Complexity, Emergence and ,Bottom-up Vs Top-Down- Determination, Chaos and Fractals.

UNIT - II

Computing Inspired by Nature: Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms , Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming

UNIT - III

Swarm Intelligence: Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO)

UNIT - IV

Immuno computing: Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding , Immune Network Theory- Danger Theory, Evaluation Interaction- Immune Algorithms , Introduction – Genetic algorithms , Bone Marrow Models , Forest's Algorithm**,** Artificial Immune Networks

UNIT - V

Computing With New Natural Materials: DNA Computing: Motivation, DNA Molecule , Adleman's experiment , Test tube programming language, Universal DNA Computers, PAM Model , Splicing Systems , Lipton's Solution to SAT Problem , Scope of DNA Computing, From Classical to DNA Computing

Text Books:

1. Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007
2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008

Suggested Reading:

1. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
2. Marco Dorrigo, Thomas Stutzle, "Ant Colony Optimization", PHI,2005

16CSE 13 SYSTEM AND NETWORK ADMINISTRATION (ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System Concepts, Computer networking basics

Course Objectives: The main objectives of this course are:
1. Understand the basic operation of system and networking.
2. Familiarize the students with system and network administration.
3. Analyze the system and network performance, issues.

Course Outcomes: On successful of this course student will be able to:
1. Understand the basics of systems administration and networking.
2. Identify and apply various system network administration tools/commands.
3. Configure various services like mail, ftp, web hosting, security.
4. Analyze various system and network performance and issues.
5. Troubleshoot various system and network services.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	2	1	1	-	-	1	2	1	2	3	2
2	3	3	3	3	3	2	1	-	2	2	2	3	3	3
3	2	2	2	2	3	1	1	-	2	2	1	2	2	2
4	2	3	3	2	2	1	1	-	1	3	2	2	3	2
5	2	3	2	3	2	-	-	-	1	2	1	2	2	1

UNIT - I

Networking Overview: Protocol standards, Reference Models (ISO-OSI, TCP/IP), Networking basics of Windows and Linux, switching and routing basics

Server Administration Basics: Server and Client Installation, boot process and startup Services: Xinetd, Managing user and group accounts, File Systems and Quota Management , Job Scheduling with *cron, crontab, anacron* and system log analysis, Process controlling and management, online server updation process.

UNIT - II

Network Configuration Basics: IPv4 and IPv6 addressing, Network Interface Configuration, Diagnosing Network startup issues, Linux and Microsoft, Firewall configuration, Network troubleshooting commands

Dynamic Host Configuration Protocol (DHCP), DHCP Principle, DHCP Server Configuration, DHCP Options, Scope, Reservation and Relaying and troubleshooting

UNIT - III

Name Server and Configuration: DNS principles and Operations, Basic Name Server and Client Configuration, Caching Only name server, Primary and Slave Name Server, DNS Zone Transfers, dynamic updates, delegation, DNS Server Security, Troubleshooting

Web and Proxy Server Configuration: HTTP Server Configuration Basics, Virtual Hosting, HTTP Caching, Proxy Caching Server Configuration, Proxy ACL, Proxy-Authentication Mechanisms, Troubleshooting

UNIT - IV

FTP, File and Print Server: General Samba Configuration, SAMBA SWAT, NFS and NFS Client Configuration, CUPS configuration basics, FTP Principles, Anonymous FTP Server, Troubleshooting

Mail Server basics: SMTP, POP and IMAP principles, SMTP Relaying Principles, Mail Domain Administration, Basic Mail Server Configuration, SPAM control and Filtering

UNIT - V

Remote Administration and Management: Router Configuration, webmin/usermin, Team Viewer, Telnet, SSH, SCP, Rsync

Text Books

1. Thomas A. Limoncelli, Christina J. Hogan , Strata R. Chalup,"The Practice of System and Network Administration", Second Edition, 2007
2. Roderick W. Smith, "Advanced Linux Networking", Addison-Wesley Professional (Pearson Education), 2002.
3. Tony Bautts, Terry Dawson, Gregor N. Purdy, "Linux Network Administrator's Guide", O'Reilly, Third Edition, 2005

Online Resources:
1. https://nptel.ac.in/courses/106106157/25
2. https://onlinecourses.nptel.ac.in/noc17_ee15/preview

Professor and Head Department

16CEO 02 DISASTER MITIGATION AND MANAGEMENTELECTIVE-V (OE1)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters.
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases in a disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions.

Course Outcomes: On Successful completion of this course, student will be able to

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels.
2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management.
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same.
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2	2	2	1	2	2	2	1	1	
2	1	1	2	2	2	3	3	1	2	1	1	1		2
3	2	2	2	2	2	2	3	2	1	1	2	1	1	
4	2	2	2	2	3	2	1	1	1	1	1	1		2
5	2	1	2	1	2	3	1	2	2	2	2	1	2	

UNIT - I

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT - II

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT - III

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storied buildings.

Professor and Head Department

UNIT - IV

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT - V

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni, "Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh, "Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs. Government of India, "National disaster management plan, Part I and II".
2. K. K. Ghosh," Disaster Management", APH Publishing Corporation, 2006.
3. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

Online Resources:

1. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)

16MEO 01 ENTREPRENEURSHIPELECTIVE-V (OE1)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Course Outcomes: On Successful completion of this course, student will be able to

1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	1	2	1	2	2	2	2	2	2	2	1
2	2	2	2	2	2	2	-	1	2	2	2	1
3	2	2	2	2	2	2	1	1	2	2	2	1
4	3	3	1	2	2	-	-	-	1	1	3	2
5	1	1	1	1	2	-	1	1	1	1	2	2

UNIT - I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT - II

Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT - III

Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT - IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT - V

Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, “Dynamics of Entrepreneurial Development and Management”, Himalaya Publishing House, 1997.
2. Prasanna Chandra, “Project-Planning, Analysis, Selection, Implementation and Review”, Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, “Entrepreneurial Development”, S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, “Entrepreneurship”, 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, “First Things First”, Simon and Schuster Publication, 1994.
3. Sudha G.S., “Organizational Behavior”, National Publishing House, 1996.

16MEO 06 RESEARCH METHODOLOGIES ELECTIVE-V (OE1)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To make the students to formulate the research problem
2. To identify various sources for literature review and data collection.
3. To prepare the research design
4. To equip the students with good methods to analyze the collected data
5. To explain how to interpret the results and report writing

Course Outcomes: On successful of this course student will be able to:
1. Define research problem
2. Review and asses the quality of literature from various sources.
3. Understand and develop various research designs.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Improve the style and format of writing a report for technical paper/ Journal report

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	-	1	-	-	1	2	2	2	1	2
2	-	2	1	2	1	-	-	-	-	2	2	2	-	2
3	1	2	3	2	2	1	-	-	1	2	-	1	1	2
4	2	2	-	3	2	-	-	-	-	2	1	1	2	2
5	-	1	-	-	1	1	-	-	1	3	-	2	-	1

UNIT – I

Research Methodology: Objectives and Motivation of Research, Types of Research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research Approaches, Significance of Research, Research Methods verses Methodology, Research process, Criteria of Good Research, Problems Encountered by Researchers in India, Technique involved in defining a problem.

UNIT–II

Literature Survey: Importance of Literature Survey, Sources of Information-primary, secondary, tertiary, Assessment of Quality of Journals and Articles, Information through Internet.

UNIT – III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Steps in sample design

UNIT – IV

Data Collection: Collection of primary data, Secondary data, Measures of central tendency-mean, mode, median, Measures of dispersion- Range, Mean deviation, Standard deviation, Measures of asymmetry (skewness), Important parametric tests -z, t, F, Chi-Square, ANOVA significance

UNIT – V

Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation- Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique", New Age International Publishers, 2004.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011

Suggested Reading:

1. Vijay Upagade and Aravind Shende, "Research Methodology", S. Chand & Company Ltd., 2009
2. G. Nageswara Rao, "Research Methodology and Quantitative methods", BS Publications, 2012.
3. Ratan Khananabis and Suvasis Saha, "Research Methodology", Universities Press, Hyderabad, 2015

16EGO 02

GENDER SENSITIZATION
ELECTIVE-V (OE1)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course Outcomes: On successful of this course **s**tudent will be able to:

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	1	-	1	-	-	-	1	1	-
2	-	-	-	-	-	-	-	1	1	1	-	1	1	-
3	-	-	-	-	-	1	-	1	1	1	-	1	1	-
4	-	-	-	-	-	1	-	1	1	1	-	1	1	-
5	-	-	-	-	-	1	-	1	1	1	-	1	1	-

UNIT – I

Understanding Gender: Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1) **Socialization:** Making Women, Making Men (*Towards a World of Equals*: Unit -2)
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II

Gender and Biology: Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4) Declining Sex Ratio. Demographic Consequences. **Gender Spectrum:** Beyond the Binary (*Towards a World of Equals*: Unit -10) Two or Many? Struggles with Discrimination.

UNIT – III

Gender and Labour: Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3) "My Mother doesn't Work." "Share the Load." **Women's Work**: Its Politics and Economics (*Towards a World of Equals*: Unit -7) Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV

Issues of Violence: Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6) Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu*". **Domestic Violence:** Speaking Out (*Towards a World of Equals*: Unit -8) Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice. Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11) Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V

Gender: Co – Existence : Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12) Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

Text Books:

1. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, 2015.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. **"I Fought For My Life…and Won."** Available online at:
3. http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Online Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTION AND EXAMINATION
VIII-Semester of B.E under CBCS
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-VIII

Sl.No	Syllabus Ref. No	SUBJECT	Scheme of Instruction		Scheme of Examination			Credits
			Periods per Week		Duration Credits of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16CSE XX	Elective-VI	3	-	3	30	70	3
2	16CSE XX	Elective-VII	3	-	3	30	70	3
3	6MT/ME/PY OXX	Elective-VIII	3	-	3	30	70	3
PRACTICALS								
7	16CSC 40	Seminar	-	3	3	50	-	2
8	16CSC 41	Project	-	6	3	50	100	6
		TOTAL	**9**	**9**		**190**	**310**	**17**

ELECTIVE-VI		**ELECTIVE-VII**	
16CSE 14	Cyber Security	16CSE 18	Bioinformatics
16CSE 15	Optimization Techniques	16CSE 19	Human Computer Interaction
16CSE 16	Natural Language Processing	16CSE 20	Social Networking and its Impact
16CSE 17	Virtual Reality	16CSE 21	Blockchain Technology

ELECTIVE-VIII (OE2)	
16MTO 04	Quantum Computing
16MEO 02	Robotics
16MEO 04	Intellectual Property Rights
16PYO 01	History of Science and Technology

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Assessment Procedure				
Course (in terms of credits)	**Continuous Internal Evaluation (Marks)**	**Semester end Examination (Marks)**	**Remarks**	**Duration of Semester End Examination**
Three(3)Credits/ Four(4)credits	30*	70**	Theory Course/ Engg . Graphics	3 Hours
Two(2) Credits	25	50	Lab Course/Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
One(1) Credit	50	-	Mini Project	-

* Out of 30 CIE, 10 marks are allotted for slip-tests (Three slip tests will be conducted, each of ten marks, and average of best two is considered) and the remaining 20 marks are based on the average of two tests, weightage for each test is 20 marks.

** The question paper will be in two parts, Part-A and Part-B. Part A is compulsory and contains short answer questions covering the entire syllabus, and carries 20 marks. Part-B carries 50 marks and covers all the units of the syllabus (student has to answer five out of seven questions).

Note: A course that has CIE but no SEE as per scheme is treated as PASS/FAIL for which pass marks are **50%** of CIE.

A candidate has earned the credits of a particular course, if he/she secures not less than the minimum marks/ grade as prescribed. Minimum pass marks in the SEE plus CIE shall be **40%** for theory courses/subjects and **50%** for lab courses /Mini Project// Project.

16CSC 40 **SEMINAR**

Instruction	3Hours per week
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:
1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Course Outcomes: On successful of this course **s**tudent will be able to:

1. To study current emerging areas of professional interest.
2. To identify promising new directions of various cutting edge technologies
3. To analyze and make use of appropriate methodologies .
4. To pursue their interest in Computer Science & Engg., through design, research, theoretical and experimental approach.
5. To effectively use modern technologies for presentation before an evaluation committee
6. To acquire skills in preparing detailed report.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2	1	-	-	-	-	-	-	3	3
2	2	2	2	2	2	1	-	-	-		-	-	2	3
3	2	2	1	2	2	-	-	-	-	-	-	-	2	2
4	2	2	2	2	2	-	-	-	-	-	-	-	3	3
5	2	2	2	2	3	1	-	-	3	2	-	-	3	3
6	2	2	2	2	2	1	-	-	2	3	-	-	-	-

Each student is required to:
1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.
4. Seminars are to be scheduled from **3rd week to the last week** of the semester and any change in schedule shall be discouraged.
5. For the award of Sessional marks students are **judged by three (3) faculty** members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
SNo	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

16CSC 41 **PROJECT**

Instruction	6 Hours per week
CIE	50 Marks
SEE	100 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Department Review Committee.

Course Outcomes: By the end of course, students will be able to:

1. Demonstrate a sound technical knowledge of their selected topic
2. Design engineering solutions to complex problems utilizing a systematic approach
3. Conduct investigations by using research-based knowledge and methods to provide valid conclusions
4. Create/select/use modern tools for the modeling, prediction and understanding the limitation of complex engineering solutions
5. Communicate with engineers and the community at large in written and oral forms
6. Demonstrate the knowledge, skills and attitudes of a professional engineer

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	--	--	--	--	--	--	--	--	--	--	--	2	2
2	2	--	3	--	--	--	--	--	--	--	--	--	2	2
3	2	--	--	3	--	--	--	--	--	--	--	--	--	--
4	2	--	--	--	3	--	--	--	--	--	--	--	--	3
5	--	--	--	--	--	--	--	--	--	3	--	--	--	1
6	2	2	--	--	2	2	--	1	3	--	2	2	--	--

Guidelines for the award of marks in CIE: (Max. Marks: 50)

CIE (Continuous Internal Evaluation) Max. Marks: 50

Evaluation by	Max .Marks	luation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Max. Marks: 100

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

16CSE 14 **` (ELECTIVE-VI)**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives: The objectives of this course are

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Course Outcomes: On Successful completion of this course, student will be able to

1. Discuss different types of cybercrimes and analyze legal frameworks to deal with these cybercrimes.
2. Describe Tools used in cybercrimes and laws governing cyberspace.
3. Analyze and resolve cyber security issues.
4. Recognize the importance of digital evidence in prosecution.
5. Analyze the commercial activities in the event of significant information security incidents in the Organization.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	1	3	1	1	1	-	-	2	-	1
2	3	2	2	3	3	2	1	2	2	1	-	2	-	2
3	2	3	1	3	3	3	1	2	3	2	2	3	-	1
4	2	2	1	3	3	3	1	2	3	2	1	2	-	1
5	2	3	2	3	3	2	1	2	3	2	2	3	-	1

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector; **Tools and Methods Used in Cybercrime:** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives**:** Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Sunit Belpre and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, “Cyber Security and Cyber Laws”, Paperback – 2018.
2. Mark F Grady, Fransesco Parisi, “The Law and Economics of Cyber Security”, Cambridge university press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

16CSE 15 OPTIMIZATION TECHNIQUES (ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To introduce fundamentals of Operation Research and Linear Programming
2. To impart knowledge on various methods to solve balanced & unbalanced transportation problems
3. To learn the working solutions of Sequencing Problems and Assignment Problems
4. To study the categories of Integer Programming Problems and Linear Programming Approach for Game Theory
5. To obtain familiarity on Construction of Network and obtaining of Critical Path

Course Outcomes: On successful of this course student will be able to:
1. Calculate the optimum values for given objective function by LPP
2. Solve the solution for maximise the profit with minimum cost by Transportation problem.
3. Determine the optimum feasible solution for sequencing the Jobs
4. Solve and analyze problems on Integer programming and other mathematical programming algorithms.
5. Learn how to deal with real world scenarios of Network analysis, Project Management, for their optimal solutions.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	-	-	-	-	1	-	-	2	-	2	-
2	2	2	2	-	-	-	-	1	-	-	2	-	2	-
3	2	2	2	-	-	-	-	-	-	-	2	-	2	-
4	2	2	2	-	-	-	-	-	-	-	-	-	2	-
5	2	2	2	-	-	-	-	2	1	1	-	-	2	-

UNIT - I

Operation Research: Introduction, Models, Areas of Application. Linear Programming (L.P.) - Mathematical Formulation of L.P. problem, Graphical Method, Simplex Method – Concept of slack, surplus & artificial variables, Manual solutions of LPP, Minimization & Maximization Problems, Special Cases – (i) Alternative optima (ii) Unbounded solutions & (iii) Infeasible solutions to be shown graphically & also by simplex method.

UNIT - II

Definition of the transportation model, Balanced / Unbalanced, Minimization / Maximization, Determination of the initial basic feasible solution using (i) North-West Corner Rule (ii) Least cost method & (iii) Vogel's approximation method for balanced & unbalanced transportation problems. Optimality Test & obtaining of optimal solution (Considering per unit transportation cost)

UNIT - III

Assignment model, Assignment Problem Formulation, Hungarian method for optimal solution, Solving unbalanced problem, Traveling salesman problem and assignment problem, Sequencing models, Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines – Processing n Jobs through m Machines.

UNIT - IV

Integer Programming Problem: Introduction, Types of Integer Programming Problems, Gomory's All-IPP Method, All IPP Algorithm, Branch and Bound Technique

Game Theory: Introduction, Game with Pure Strategies, Game with Mixed Strategies, Dominance Property, Graphical Method for 2 X n or m x 2 Games, Linear Programming Approach for Game Theory.

UNIT - V

Construction of Network – Rules & Precautions, C.P.M. & P.E.R.T. Networks, Obtaining of Critical Path, Time estimates for activities, Probability of completion of project, Determination of floats (total, free, independent & interfering)

Text Books:
1. Kanti Swarup, P. K. Gupta, Man Mohan, "Operations Research", Sultan Chand Publications.
2. R. Pannerselvam, "Operations Research", PHI

16CSE 16 NATURAL LANGUAGE PROCESSING (ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. To learn the fundamentals of natural language processing.
2. To understand the various Parsing techniques NLP.
3. To understand the role of semantics of sentences and pragmatics and apply the NLP techniques to IR applications.

Course Outcomes: On successful of this course student will be able to:

1. Define the basic concepts of grammars languages and applications of Natural Language processing --
2. Discuss about the language modelling techniques
3. Identify the basic words, parsers and various levels in processing of natural language.-
4. Explain the various semantics discourse and pragmatic levels of NLP
5. Analyze Natural language Generation and apply machine translation.
6. Implement levels of NLP system using the Components or lexical resources to demonstrate Morphology / syntax of a language.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	-	1	-	-	-	-	-	-	-	3		
2	3	2	1	2	3	-	-	-	-	-	-	1	1	3
3	3	2	1	1	-	-	-	-	-	-	-	1	-	-
4	3	3	1	2	-	-	-	-	-	-	-	1	-	-
5	3	2	1	2	2	-	-	-	-	-	-	2	-	-
6	3	3	1	2	-	-	-	-	-	-	-	2	-	-

UNIT - I

Overview and Language Modeling

Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval. **Language Modeling:** Introduction-Various Grammar-based Language Models-Statistical Language Model.

UNIT - II

Word Level and Syntactic Analysis

Word Level Analysis: Introduction Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. **Parsing:** Constituency Parsing - Probabilistic Parsing.

UNIT - III

Semantic Analysis and Discourse Processing

Semantic Analysis: Introduction- Meaning Representation-Lexical Semantics Ambiguity-Word Sense Disambiguation. **Discourse Processing:** Introduction- cohesion-Reference Resolution Discourse Coherence and Structure.

UNIT - IV

Natural Language Generation and Machine Translation

Natural Language Generation: Introduction-Architecture of NLG Systems Generation Tasks and Representations-Application of NLG. Problems in Machine Translation, Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages.

UNIT - V

Applications and Lexical Resources: Information Extraction, Automatic Text Categorization and Text Summarization, Question-Answering System. LEXICAL RESOURCES: Introduction - WordNet- FrameNet – Stemmers - POS Tagger, Research Corpora, NLTK.

Text Books:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

Suggested Reading:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, Prentice Hall, 2nd Edition, 2008.
2. James Allen, Bejamin/cummings, “Natural Language Understanding”, 2nd edition, 1995.

16CSE 17 VIRTUAL REALITIES (ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Provide detailed understanding of the concepts of Virtual Reality and applications
2. Understand geometric modeling and virtual environment
3. Prepare the students to develop Virtual Reality applications

Course Outcomes: On successful of this course student will be able to:
1. Understand the fundamental concepts of Virtual Reality
2. Identify the applications of Virtual Reality
3. Know the virtual hardware and software
4. Familiarize with various VR technologies
5. Design and Develop Virtual Reality based applications

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	-	-	1	-	-	-	-	-	-	-	1	1
2	1	2	2	2	1	-	-	-	-	-	-	-	1	1
3	2	2	2	2	1	-	-	-	-	-	-	-	1	1
4	1	1	1	1	2	-	-	-	-	-	-	-	1	2
5	2	2	3	2	3	1	-	-	-	-	-	-	1	1

UNIT - I

Introduction to Virtual Reality- Introduction, Computer Graphics, real time computer graphics, flight simulation, virtual environment requirement, benefits of virtual reality, historical development of VR, scientific landmark; **3D Computer Graphics:** Introduction, virtual world space, positioning the virtual observer, perspective projection, human vision, stereo perspective projection, 3D clipping, color theory, simple 3D modeling, illumination models, reflection models, shading algorithms, radiosity, Hidden surface removal, realism0stereographic image

UNIT - II

Geometric Modeling: Introduction, 2d to 3D, 3D space curves, 3D boundary representation, **Geometric Transformations:** Introduction, frames of reference, modeling transformations, instances, picking, flying, scaling the VE, collision detection; **Generic VR system**: Introduction, virtual environment, computer environment, VR technology, Model of interaction, VR systems

UNIT - III

Virtual Environment: Introduction, dynamics of numbers, linear and non-linear interpolation, animation of objects, linear and non-linear translation, shape and object in between, free from deformation, particle system, **Physical Simulation:** Introduction, objects falling in a gravitational field, rotarotating wheels, elastic collisions, projectivities, simple pendulum, springs, flight dynamics of an aircraft

UNIT - IV

VR Hardware and Software: Human factors-eys, ear and somatic senses; **VR Hardware**: Introduction, sensor hardware, hed-coupled displays, acoustic hardware, integrated VR system; **VR Software:** Modeling virtual world, physical simulation, VR toolkits, introduction to VRML

UNIT - V

VR Applications: Engineering, Entertainment, Science, Training, **Future:** Virtual environment, modes of interaction

Text Books:

1. John Vince, “Virtual Reality Systems”, Pearson Education Asia, 2007
2. Anad R., “Augmented and Virtual Reality”, Khanna Publishing House, Delhi

Suggested Reading:

1. Adams, “Visualization of Virtual Reality”, Tata McGraw Hill, 2000
2. Grigore C. Burdea, Philippe Coiffet, “Virtual Reality Technology”, Wiley Inter Science, 2nd Edition, 2006
3. William R Sherman, Alan B Craig, “Understanding Virtual Reality: Interface, Applications and Design”, Morgan Kaufman, 2008

Online Resources:
1. www.vresources.org
2. www.vrac.iastate.edu
3. www.w3.org/MarkUp/VRM

16CSE 18 BIOINFORMATICS (ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Understand the basic concepts, search and visualize information.
2. Learn various bioinformatics algorithms.
3. Understand various data mining and pattern matching techniques.

Course Outcomes: On successful of this course student will be able to:

1. Understand the basics concepts of Bioinformatics and its significance in Biological data analysis.
2. Represent biological information using various algorithms
3. Apply data mining and pattern matching techniques
4. Choose and apply appropriate statistical methods for solving complex biological problems.
5. Reviewing the various bioinformatics tools and their Applications.
6. Design real-time solutions by using basic principles of biology, Computer Science and mathematics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	2	3	3	3	3	2	2	2	2	1	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	2	2	3	3	3	3	3	2	2	3	3	3
4	3	3	2	3	2	2	2	2	2	2	2	3	3	2
5	3	2	2	3	3	2	2	3	3	2	3	3	2	2
6	2	2	3	3	3	3	3	3	3	3	3	3	2	2

UNIT - I

Introduction to Bio-Linux and Networks: Introduction to networking in Linux, Basic commands in linux-pwd, awk, grep, sed, ls, remote login, ftp, wget, different shells such as c shell, Network basics and tools, File Transfer protocol in Linux, Network File System, Domain Name Services, Networks, Geographical Scope, Communication Models, Transmissions Technology.

UNIT - II

Bio-Basics: Kingdom of life-Bacteria, virus, plant, animal-Central dogma-chromosome-Prokaryotic genes and eukaryotic genes, Gene expression,-Genetic code-Protein synthesis basics, protein structures.

UNIT - III

Pattern matching: Pair-wise sequence alignment, Local versus global alignment, BLAST and its versions, Multiple sequence alignment, Dot Matrix analysis, Substitution matrices, Dynamic Programming, Word methods, Bayesian methods, Multiple sequence alignment, Dynamic Programming, Progressive strategies ,Iterative strategies, Tools, Nucleotide Pattern Matching, Polypeptide pattern matching, Utilities, Sequence Databases protein structure determination- abinito-threading- homology modeling methods.

UNIT IV

Bio-Statistics: Statistical concepts, Imperfect Data, Randomness, Variability, Approximation, Interface Noise, Assumptions, Sampling and Distributions, Hypothesis Testing, Quantifying Randomness, Data Analysis, Tool selection statistics of Alignment, Clustering and Classification.

UNIT V

Biodatabases and Data Mining: Biodatabase- basics of PHP, MySQL or MongoDB, HTML, CSS, java scripting Basics or Wordpress, Data Mining: Methods, Selection and Sampling, Preprocessing and Cleaning, Transformation and Reduction, Data Mining Methods, Evaluation, Visualization, Designing new queries, Pattern Recognition and Discovery, Machine Learning ,Text Mining , Tools.

Text Books:

1. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education, 2015.
2. T.K.Attwood and D.J. Perry Smith, “Introduction to Bio Informatics, Longman Essen, 1999.
3. JinXiong, “Essential Bio Informatics”, Cambridge University Press,2006.

Suggested Readings:

1. Neil C.Jones, PaveA. Pevzner, ”An Introduction to, Bioinformatics Algorithms (Computational Molecular Biology)”, MIT Press 2004.

Online Resources:

1. https://nptel.ac.in/courses/102106065/
2. https://www.ncbi.nlm.nih.gov/

16CSE 19

HUMAN COMPUTER INTERACTION (ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Learn the foundations of Human Computer Interaction.
2. Familiarize with the design technologies for computer interaction.
3. Learn the design strategies, guidelines, models and theories for developing a user friendly interface.

Course Outcomes: On successful of this course student will be able to:
1. Understand the structure of models and theories of human computer interaction.
2. Understand the vision of a computer user.
3. Understand the recognition and remembrance limitations of a computer user.
4. Understand the design rules and design process.
5. Apply the models and theories of human computer interaction to real-time problems

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	-	-	-	-	-	1	-	1		
2	3	1	2	1	1	-	-	-	-	1	-	1		
3	3	1	2	1	1	2	-	-	-	1	-	1		
4	3	1	1	1	1	2	1	-	1	1	-	1		
5	3	1	1	1	1	2	1	-	1	1	-	1		

UNIT - I

Foundations: The human, The computer, The Interaction, Paradigms. Introduction, Our perception is biased, Our vision is optimized to see structure

UNIT - II

We Seek and Use Visual Structure, Our Color Vision is Limited, Our Peripheral Vision is Poor, Reading is Unnatural, Our Attention is Limited; Our Memory is Imperfect, Limits on Attention Shape Our Thought and Action

UNIT - III

Recognition is Easy; Recall is Hard, Problem Solving and Calculation are Hard, Many Factors Affect Learning, Human Decision Making is Rarely Rational

UNIT - IV

Our Hand–Eye Coordination Follows Laws, We Have Time Requirements, Well-known User-Interface Design Rules, Design Process**:** Interaction design basics, HCI in the software process, Design rules

UNIT - V

Models and Theories: Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models, Task analysis, Hypertext, multimedia and the World Wide Web.

Text books:

1. Jeff Johnson, “Designing with the Mind in Mind – Simple Guide to Understanding”, 2nd edition, Elsevier Inc., 2010.
2. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, “Human Computer Interaction”, 3rd edition, Pearson Education Limited, 2004.

Suggested Reading:

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, “Designing the User Interface”, 5th Edition, Pearson Education Limited, 2013.
2. John Haugeland, “Mind Design II”, 2nd Edition, Revised and enlarged edition, The MIT Press, 1997.

16CSE 20 SOCIAL NETWORKING AND ITS IMPACT(ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Familiarize the students with social networks and their representation.
2. Understand the impact of social networks on society.
3. Study and Analyze the social network search models.

Course Outcomes: On successful of this course student will be able to:

1. Understand a broad range of social networks concepts and theories.
2. Appreciate how network analysis can contribute to increasing knowledge about diverse aspects of society.
3. Analyze social network links and web search.
4. Communicate the analysis results and impact of social networks.
5. Differentiate between centralized and decentralized search models.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	1	1	-	1	1	-	1	1	-
CO2	3	2	1	-	-	-	-	-	-		-	-	1	1
CO3	2	2	2	1	-	1	-	-	-	1	-	-	1	1
CO4	2	2	1	2	1	1	-	-	-	-	-	-	1	1
CO5	3	2	2	1	-	-	-	-	-	1	-	-	1	1

UNIT - I

Introduction: to Social Networks: Introduction to Social Networks, Challenges, Google page rank, Searching on network, link prediction, contagious, marketing on social networks; **Graphs**: Basic definitions, paths and connectivity, distance and breadth first search, network datasets. **Strong and Weak Ties**: Triadic closure, strength of weak Ties, Tie strength and network structure in large-scale data, Tie strength, social media and passive engagement, closure, structured holes and social capital.

UNIT - II

Networks in surrounding contexts: Homophily, selection and social influence, affiliation, tracking link formation in online data, spatial model of segregation. **Positive and negative relationships**: Structural balance, characterizing the structure of balanced networks, applications of structured balance.

UNIT - III

Link analysis and Web search: Searching the web, ranking, link analysis using hubs and authorities, page rank, link analysis in modern web search, applications beyond web.

Cascading behavior in networks: Diffusion in networks, modeling diffusion, cascades and clusters, diffusion, thresholds and role of weak Ties, extensions of cascade model, knowledge, thresholds and collective actions

UNIT - IV

Power Laws and Rich-get-Richer Phenomena: Popularity as a network phenomenon, power laws, rich-get-richer models, unpredictability of rich-get-richer effects, effects of search tools and recommender systems, analysis of rich-get-richer processes. Pseudo core- how to go viral on the web

UNIT - V

Small world phenomenon: Six degrees of separation, structured and randomness, decentralized search, modeling the process of decentralization search, empirical analysis and generalized models, core-peiphery structures and difficulties in decentralized search, analysis of decentralized search.

Text Books:

1. David Easley, Jon Kleinberg, “Networks, Crowds and Markets”, Cambridge Press, 2010 (available for free download).
2. Mathew O Jackson “Social and Economic Networks”, Princeton University, 2010.

Online Resources:

1. https://nptel.ac.in/downloads/106106169/

16CSE 21 BLOCKCHAIN TECHNOLOGY (ELECTIVE-VII)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Computer Networks, Network Security

Course Objectives: The main objectives of this course are:

1. Understand the basic concepts and architecture of blockchain
2. Interpret working of Hyperledger Fabric
3. Applications of blockchain in various domains

Course Outcomes: On successful of this course student will be able to:

1. State the basic concepts of blockchain
2. Understand the list of Consensus
3. Demonstrate and Interpret working of Hyperledger Fabric, SDK composer tool
4. Demonstrate the supply chain.
5. Apply to various use cases from different domains

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
2	3	3	2	1	-	-	-	-	-	-	-	-	-	-
3	3	3	1	2	1	-	-	-	-	-	-	-	-	-
4	3	2	1	-	-	-	-	-	-	-	-	-	-	-
5	3	3	1	-	-	-	-	-	-	-	-	-	-	-

UNIT - I

Introduction: History: Digital Money to Distributed Ledgers - Design Primitives: Protocols, Security, Consensus, Permissions, Privacy-: Blockchain Architecture and Design-Basic crypto primitives: Hash, Signature-Hashchain to Blockchain-Basic consensus mechanisms

UNIT - II

Consensus: Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Blockchain consensus protocols**:** Permissioned Blockchains-Design goals-Consensus protocols for Permissioned Blockchains

UNIT - III

Hyperledger Fabric: Decomposing the consensus process-Hyperledger fabric components-Chaincode Design and Implementation: Hyperledger Fabric II:-Beyond Chaincode: fabric SDK and Front End-Hyperledger composer tool

UNIT - IV

Use Case I: Blockchain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital markets-Insurance- **Use case II:** Blockchain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting

UNIT - V

Use Case III: Blockchain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems : Blockchain Cryptography : Privacy and Security on Blockchain

Text Books:

1. Mark Gates, "Blockchain: Ultimate guide to understanding blockchain, bitcoin, cryptocurrencies, smart contracts and the future of money", Wise Fox Publishing and Mark Gates, 2017.
2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer", 2018.
3. ArshdeepBahga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", ArshdeepBahga, Vijay Madisetti publishers 2017.

Suggested Reading:

1. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media, Inc., 2014.
2. Melanie Swa, "Blockchain ",O'Reilly Media, 2014

E-Books :

1. Blockchain Applications- https://www.blockchain-books.com
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
3. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits,2017 - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_cs47/preview
2. https://www.udemy.com/blockchain-and-bitcoin-fundamentals/

16MTO 04 QUANTUM COMPUTINGELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are :

1. Translate fluently between the major mathematical representations and its quantum operations.
2. Implement basic quantum algorithms.
3. Explain quantum decoherence in systems for computation.
4. Discuss the physical basis of uniquely quantum phenomena.

Course Outcomes: On successful of this course student will be able to:

1. Explain the working of a Quantum Computing Program, its architecture and program model.
2. Compute basic mathematical operations.
3. Develop quantum logic gate circuits.
4. Develop quantum algorithm.
5. Program quantum algorithm on major toolkits.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	-	1	1	-
2	2	3	-	-	-	-	-	-	-	-	-	1	1	-
3	3	2	-	-	-	-	-	-	-	-	-	1	1	-
4	2	2	-	-	-	-	-	-	-	-	-	1	1	-
5	2	2	-	-	-	-	-	-	-	-	-	1	1	-

UNIT – I

Introduction to Quantum Computing: Motivation for Studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc), Origin of Quantum Computing, Overview of major concepts in Quantum Commuting (Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement).

UNIT – II

Math Foundation for Quantum Computing: Matrix Algebra: Basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen Vectors.

UNIT – III

Building Blocks for Quantum Program: Architecture of a Quantum Computing Platform, Details of q-bit system of information representation (Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from Quantum algorithmic perceptive e.g. Bell State.

UNIT – IV

Quantum Logic gates and Circuits: Quantum Logic gates and Circuit:Pauli, Hadamard, Phase shift, controlled gates, ising, Deutsch, Swap etc.), Programming model for a Quantum Computing program (Steps performed on classical computer, steps performed on Quantum Computer, Moving data between bits and qubits).

UNIT – V

Quantum Algorithms: Basic techniques exploited by quantum algorithms (Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum walks), Major Algorithms (Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm), OSS Toolkits for implementing Quantum program (IBM quantum experience, Microsoft Q, Rigetti PyQuil (QPU/QVM)).

Text Books:

1. Michael A.Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quanturm Computing Explained", Wiley.

16MEO 02 ROBOTICSELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. The configuration, work envelop and motion controls and applications
2. The kinematics and dynamics of robots.
3. Robot end effectors and their design.
4. Robot Programming Languages and Programming methods of robot.
5. Various Sensors and drives and their applications in robots

Course Outcomes: On successful of this course student will be able to:

1. Equipped with the knowledge of robot anatomy, work volume and robot applications
2. Familiarized with the kinematic motions of robot and robot dynamics
3. Having good knowledge about robot end effectors and their design concepts
4. Equipped with the Programming methods & drives used in robots
5. Equipped with the principles of various Sensors and their applications in robots.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	2	3	3	3	3	1	3	3	2	3	1	1
CO 2	3	3	3	3	3	0	1	0	2	3	1	3	1	1
CO 3	3	3	3	3	3	0	1	0	2	3	1	3	2	2
CO 4	2	3	3	3	3	3	2	1	3	3	2	3	3	2
CO 5	3	3	3	3	3	3	3	1	3	3	2	3	3	2

UNIT-I

Introduction to Robotics: History and evolution of robots, basic configuration, degree of freedom, work envelope, motion control methods. Various applications in industry: material handling, loading & unloading, processing, welding & painting, assembly and inspection. Requirements and Specifications of Robots

UNIT-II

Rigid Motions and Homogeneous Transformations: Rotation matrix, Homogenous transformation matrix, Denavit-Hartenberg convention, Euler angles, RPY representation, Direct and inverse kinematics for industrial robots for position and orientation.

UNIT-III

Velocity Kinematics – The Manipulator Jacobian: Joint, End effector velocity, direct and inverse velocity analysis. **Trajectory Planning**, interpolation, cubic polynomial, linear segments with parabolic blending, static force and moment transformation, solvability, stiffness, singularities.

UNIT-IV

Robot Dynamics: Lagrangian formulation, link inertia tensor and manipulator inertia tensor. **Newton**-Euler formulation for RR & RP manipulators. **Control**: Individual joint, computed torque.

UNIT-V

End Effectors: Position and velocity measurement, **Sensors**: Proximity and range, tactile, force and torque, Drives for Robots: Electrical, Hydraulic and Pneumatic. **Robot Vision**: Introduction to technique, image acquisition and processing, introduction to robot programming languages.

Text Books:

1. Spong and Vidyasagar, “Robot Dynamics and Control”, John Wile and Sons, 1990
2. R.K. Mittal, I.J. Nagrath, “Robotics and control”, Tata Mcgraw-Hill Publishing Company Ltd. 2003
3. Groover, “Industrial Robotics”, Mcgraw-Hill Publishing Company Ltd. 2003

Suggested Reading:

1. Asada and Slotine, “Robot analysis and Intelligence”, Wiley Interscience, 1986
2. K.S. Fu Gon ZalezRC., lEEc.S.G., “Robotics, Control Sensing Vision and Intelligence”, McGraw Hill, Int. Ed., 1987
3. Richard S. Paul, “Robot Manipulators: Mathematics, Programming, and Control”, MIT Press

16MEO 04 INTELLECTUAL PROPERTY RIGHTS ELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

Course Outcomes: On successful of this course **s**tudent will be able to:
1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	3	-	1	-	-	-	2	-	-	-
2	-	-	-	-	3	-	1	-	-	-	2	-	-	-
3	-	-	-	-	3	-	1	-	-	-	2	-	-	-
4	-	-	-	-	3	-	1	-	-	-	2	-	-	-
5	-	-	-	-	3	-	1	-	-	-	2	-	-	-

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT, **Patents:** Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT-III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection. **Unfair Competition:** What is unfair competition. Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications", Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications", Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan, "Law of Copyright and Industrial Designs", Eastern law House, Delhi 2010

Suggested Reading:

1. W.R1 Cronish, "Intellectual Property; Patents, copyright, Trad and Allied rights", Sweet & Maxwell, 1993.
2. Narayanan, "Intellectual Property Law", Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs", 4/e, Sweet, Maxwell.

16PYO 01 HISTORY OF SCIENCE AND TECHNOLOGY ELECTIVE-VIII (OE2)

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70 Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Enable students to understand science as a socio-cultural product in specific socio-historical contexts.
2. Expose students to philosophical, historical and sociological perspectives to look at science as a practice deeply embedded in culture and society.
3. Inculcate the scientific culture and ethics in the development of technologies.

Course Outcomes: On successful of this course student will be able to:
1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rig our and a sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	1	2	2	1	1	2	1	2		
2	3	1	2	1	2	2	2	1	2	2	2	2		
3	2	2	1	1	1	1	1	1	1	2	1	2	1	1
4	3	2	2	2	2	2	2	1	1	2	1	2	1	1
5	3	2	2	2	2	1	2	2	1	2	1	2	1	1

UNIT - I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization, Major advances. **Science in Antiquity (600 BC - 529 AD):** Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT - II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances. **The Renaissance and the Scientific Revolution (1453 AD – 1659 AD):** Renaissance, Scientific Revolution, Technology, Major advances.

UNIT - III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances. **The Industrial Revolution (1735 AD – 1819 AD):** Industrial Revolution, Rise of the engineer, Major Advances.

UNIT - IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances. **Rise of Modern Science and Technology (1895 AD – 1945 AD):** The growth of 20thcentury science, New philosophies, Quantum reality, Energy sources, Electricity: a revolution in Technology, Major advances.

UNIT - V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances. **The Information Age (1973 AD – 2015 AD):** Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances

Text Books:
1. Bryan and Alexander Hellemans, "The History of Science and Technology", Houghton Mifflin Company, 2004.
2. JD Bernal, "Science in History", 4 volumes, Kindle Edition.

Suggested Readings:
1. "The 100 Most Influential Scientists of All Time", Edited by Kara Rogers, Britannica Educational Publishing, 2010

2. Alberto Hernandez, "A Visual History of Science and Technology", The Rosen Publishing Group, 2016

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

(CBCS CURRICULUM)

OPEN ELECTIVE FOR OTHER PROGRAMME

S.NO.	SUBJECT CODE	SUBJECT NAME
1	16CSO 01	Python for Bioinformatics
2	16CSO 02	JAVA Programming and Bio-Java
3	16CSO 03	IOT and Applications
4	16CSO 04	Basics of Data Science using R
5	16CSO 05	Fundamentals of Virtual Reality
6	16CSO 06	Fundamentals of DBMS
7	16CSO 07	Basics of Cyber Security
8	16CSO 08	Open Source Technologies
9	16CSO 09	Basics of Artificial Intelligence
10	16CSO 10	Machine Learning Using Python

16CSO 01

PYTHON FOR BIOINFORMATICS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Introduce Python with reference to bioinformatics.
2. Understanding of various algorithms useful for biological sequences.
3. Identification Python modules useful to analyze gene and Biological sequences

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics of Python Programming.
2. Develop applications using Python to solve problems.
3. Identify and use Python modules related to Biology.
4. Analyze biological and gene sequences using Python.
5. Understand advanced analysis techniques.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	1	-	-	-	-	-	-	-	1	1	1
2	2	3	2	2	1	-	-	-	-	-	-	1	2	2
3	2	2	2	1	2	1	-	-	-	-	-	1	2	1
4	1	2	2	2	2	2	1	-	-	-	-	1	2	1
5	-	3	2	1	1	1	-	-	-	-	-	-	1	2

UNIT - I

Introduction to Python: Basics of Python, Python IDEs, Running Python programs, types and operations, Functions, modules, classes, Exceptions.

UNIT - II

Object-Oriented Programming, Modules: Object Oriented Programming, Threads, process, synchronization, databases and persistence, NumPy, SciPy, Image manipulation, Akando and Dancer modules.

UNIT - III

Biological Sequence Analysis: Biopython: Parsing DNA data files, Sequence Analysis, Dynamic Programming, Hidden Markov Model, Genetic Algorithms, Multiple Sequence Alignment, gapped alignment.

UNIT - IV

Advanced Analysis Techniques: Trees, Text Mining, Clustering, Self-Organizing Map, Principal Component Analysis and Numerical Sequence Alignment.

UNIT - V

Expression Analysis: Gene expression array analysis, Spot finding and Measurement, Spreadsheet Arrays and Data Displays, Applications with expression Alignment.

Text Books:
1. Jason Kinser, "Python for Bioinformatics", Jones & Bartlett Publishers, 2nd Edition, 2013.
2. Reema Thareja "Python Programming", Oxford Press, 2017.

Suggested Reading:
1. Mark Lutz, "Learning Python", 3rd edition, O'Reilly, 2007.
2. Alex Martelli, David Ascher, "Python cookbook", O'Reilly, 2002.

Online Resources:
1. http://www.biopython.org

16CSO 02

` JAVA PROGRAMMING AND BIO-JAVA
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basics of any programming language.

Course Objectives: The main objectives of this course are:

1. To introduce the concepts of Object-Oriented programming.
2. Prepare the students to develop solutions using OOPs concepts.
3. Design and develop Biotechnology related solutions using Java and Java class libraries.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand fundamental concepts in object-oriented programming.
2. Design and develop computer based solutions to solve real world problems.
3. Handle file I/O and exceptions.
4. Create Windows, Containers, GUI components in Java.
5. Create GUI-based applications related to Biotechnology problems.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	-	-	1	1	-	-	-	-	1	1	-
2	2	2	3	2	1	1	1	-	-	-	-	1	2	1
3	2	2	2	1	2	-	-	-	-	-	-	1	1	1
4	2	2	1	1	1	-	-	-	-	-	-	1	1	1
5	2	2	3	1	2	-	-	-	-	-	-	2	2	2

UNIT - I

Java Essentials: Features of Java, OOPs concepts in Java, Elements of java program, Variables, and Literals, Data Types, variables and arrays, Operators, arrays Control structures: if, if-else, nested if, if-else-if, switch, while, do-while, for, break and continue statements.

UNIT - II

Classes and Objects: Introduction to classes and methods, typecasting, access specifiers and modifiers, modifiers, passing arguments, Constructors. Inheritance: Basics of inheritance, types of inheritance, polymorphism.

UNIT - III

Interfaces and Packages: Basics of interfaces, Packages, Exception handling: Types of exceptions and Errors, exception handling, Multithreading concepts. Files and I/O Streams: File Class, Streams, Byte Streams.

UNIT - IV

AWT and Applets: Applets, GUI, Window class hierarchy, Dialog Boxes,, Layout managers, Swing Component Classes, Event-Handling, AWT Graphics classes and Swing Controls.

UNIT - V

StrBio Lib: Molecular Biology Classes, Interfaces to Bioinformatics tools and Databases, General purpose tools, applications. Writing simple Java programs for Biotechnology related problems.

Text Books:

1. Sagayaraj, Denis, KArthik and Gajalaxmi, “Java Programming”, for Core and Adanced Learners”, University Press, Pvt. Ltd, 2018.
2. Johan-Marc Chandonia, “StrBioLib: a Java Library for Development of Custom Computations Structural Biology Applications”, BIO-INFO ALPPLICATIONS NOTE, Vol. 23, No. 15,2007, PP2018-2020 (https:// academic.oup.com/bioinformatics/article-abstract/23/15/2018/203542)

Suggested Reading:

1. Herbert Schildt, “ The complete reference Java 2”, TMH
2. Internet World 60 minute Java by Ed Tittel

Online Resources:

1. https://www.tutorialspoint.com/java/index.htm

16CSO 03

IOT AND APPLICATIONS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Programming Basics.

Course Objectives: The main objectives of this course are:

1. Impart necessary and practical knowledge of components in Internet of Things.
2. Understand working of IoT Systems.
3. Develop skills required to build IoT based systems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand Internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Remotely monitor data and control devices.
4. Develop real time IoT based projects.
5. Advance towards research based IoT.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	-	-	-	-	-	-	-	-	1	1	1
2	3	2	2	-	1	-	-	-	1	-	1	1	1	1
3	3	3	2	1	1	-	-	-	-	-	1	1	1	1
4	2	2	2	-	1		-	-	1	-	1	1	1	1
5	2	2	1	2	-	-	-	-	-	-	-	1	1	1

UNIT – I

Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators and Types of Actuators.

UNIT – II

Basics of Networking: Functional Components of IoT, IoT interdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

UNIT – III

IoT Hardware Components: Computing (Arduino/Raspberry Pi), Communication, Sensors, Actuators, I/O interfaces, Programming API's (for Arduino/ Raspberry Pi).

UNIT – IV

IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, Authorization of devices

UNIT – V

IoT Systems and Applications: Smart Lighting, Weather Monitoring System, Weather Reporting Bot, Forest Fire Detection, Alcohol Detection System, Smart Parking Environment.**,** Drip-irrigation, Biological water treatment system**,** Work flow Automation in Industries, Smart Intrusion Detection System, monitoring space risks and hazardous conditions in industrial regions like underground tanks, trap door margins.

Text Books:

1. Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, “Internet of Things:Architecture and Design”, McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, “Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers, Series in Communications, 2013.

Online Resources / Weblinks / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, “Internet of Things in Industries: A Survey “, IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. Gotovtsev, Pavel M., and Andrey V. Dyakov. "Biotechnology and Internet of Things for green smart city application." 2016 IEEE 3rd World Forum on Internet of Things (WF-IoT). IEEE, 2016.
3. Yanjing, Sun, et al. "Research and design of agriculture informatization system based on IOT." Journal of Computer Research and Development 48 (2011): 316-331.
4. Somov, Andrey, et al. "Bacteria to power the smart sensor applications: Biofuel cell for low-power IoT devices." 2018 IEEE 4th World Forum on Internet of Things (WF-IoT). IEEE, 2018.
5. Han, Shuqing, et al. "Analysis of the frontier technology of agricultural IoT and its predication research." IOP Conference Series: Materials Science and Engineering. Vol. 231. No. 1. IOP Publishing, 2017.

16CSO 04

BASICS OF DATA SCIENCE USING R
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Probability and Statistics, basics of programming languages.

Course Objectives: The main objectives of this course are:
1. Understand R programming language.
2. Explore the programming skills needed to use R tool for statistical analysis of Biological data.
3. Analyze biological data.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics of R, various statistical measures, algorithms useful for data analysis.
2. Explore the programming skills needed to use R tool for biological data.
3. Analyze biological data using R tool.
4. Apply classification and clustering algorithms to biological data.
5. Identify and work with the technologies and resources related to bioinformatics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	3	2	-	-	-	1	1	2	2	-
2	3	3	2	3	2	2	-	-	1	1	2	2	2	1
3	3	3	2	2	2	2	-	-	1	2	3	2	2	1
4	3	3	3	2	3	2	-	-	1	3	2	3	2	-
5	3	3	2	2	2	2	-	-	1	2	2	2	2	1

UNIT - I
Basics of R: Introduction, R features, setting up and exploring R environment, loading packages, types of data objects in R, working with R data objects, Controlling work space, importing files. **Programming with R:** Variables and assignment, operators, control structures, Functions-built-in, writing own functions, package creation.

UNIT - II
Data Analysis and Graphics: Data summary functions in R, Graphics technology in R, saving graphics, additional graphics packages. **Bayesian Data Analysis**: Need of Bayesian approach, Application of Bayes rule, Priors, Likelyhood functions, evaluating the posterior, Applications of Bayesial Statistics in Bioinformatics. **Stochastic Modeling**: Stochastic process and Markov Processes, Classification of Stochastic processes, modeling a DNA sequence with Markov Chain, Characteristics of Markov Chain.

UNIT - III
MCMC using Brugs: ABO blood type example. Gibbs sampling. **Statistical Inference:** Sampling distributions, Parameter estimation, interval estimation, bootstrapping, R packages for bootstrapping. **Hypothesis Testing**: Package ctest, Binomial test, comparing variances, Wilcoxon tests, Chi-Square test, Fisher's Exact tests, Likelihood Ratio tests.

UNIT - IV
ANOVA and Regression: ANOVA table, perforating ANOVA using R, graphical analysis of ANOVA comparison, Regression: Correlations, linear regression model, fitting and testing of regression model, generalization of the model. **Working with Multivariate Data:** Multivariate data, sample statistics, display of multivariate data, outliers and principal components. Classification of discriminate analysis- classification with two population and more than two populations, cross validation classification trees.

UNIT - V

Clustering methods: measures of dissimilarities, K-means clustering, K-Medoid clustering, Hierarchical clustering-Agglomerate and divisive. **R Packages:** Bio-conductor and Seqin R.

Data Technologies: R for Data manipulation, example, Database technologies, Bioinformatics resources on the WWW.

Text Books:

1. Kim Seefeld, Ernest Linder, "Statistics using R with Biological examples", 2007 (https://cran.r-project.org/doc/contrib/Seefeld_StatsRBio.pdf).
2. Robert Gentleman, "R Programming for Bioinformatics", 1st Edition, CRC Press, 2008.

Suggested Reading:

1. Arvil Cohhlan "A Little Book of R for Bioinformatics", Release 1.0, CC ver 3.0

Online Resources:

1. https://epdf.tips/r-programming-for-bioinformatics.html
2. https://epdf.tips/r-programming-for-bioinformatics.htmlhttps://www.cyclismo.org/tutorial/R/objectOriented.html
3. https://www.w3schools.in/r/object-oriented/

16CSO 05

FUNDAMENTALS OF VIRTUAL REALITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. To introduce hardware and software components of virtual reality.
2. To provide knowledge about geometry of virtual worlds.
3. To understand visual physiology, perception and audio in VR.
4. To study the applications of VR in various domains like military and robotics.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Define Virtual Reality and acquire knowledge of virtual worlds.
2. Apply modeling techniques to model real world scenarios.
3. Study human factors for developing interfaces.
4. Evaluate virtual reality systems.
5. Address the issues and challenges in virtual reality.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	-	-	-	-	-	-	-	-	-	1	1	1
2	2	2	2	2	2	1	-	-	-	-	-	-	1	1
3	1	1	1	2	2	2	1	-	-	-	-	1	1	1
4	2	2	2	2	2	-	-	-	-	--	-	-	1	1
5	1	1	1	1	1	2	2	2	-	-	-	1	1	1

UNIT - I
Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. **Input Devices:** Trackers, Navigation and Gesture Interfaces: Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. **Output Devices:** Graphics displays, sound displays and haptic feedback.

UNIT - II
Geometry of Virtual Worlds: Geometric modeling, Transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, Axis-angle representations, Quaternions, Converting and multiplying rotations, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Canonical view transform , Viewport transform.

UNIT - III
Light and Optics : Three interpretations of light, Refraction, Simple lenses, Diopters, Imaging properties of lenses, Lens aberrations, Optical system of eyes. **Visual Physiology:** Photoreceptors, Sufficient resolution for VR, Light intensity, Eye movements, Eye movement issues for VR, Neuroscience of vision, **Visual Perception:** Depth perception, Motion perception, Frame rates and displays.

UNIT - IV
Tracking Systems : Overview, Orientation tracking, Tilt drift correction, Yaw drift correction, Tracking with a camera, Perspective n-point problem, Filtering, Lighthouse approach, **Visual Rendering:** Overview, Shading models, Rasterization, Pixel shading, VR-specific problems, Distortion shading, Post-rendering image warp.

UNIT – V
Audio: Physics and physiology, Auditory perception, Auditory localization, Rendering, Spatialization and display, Combining other senses, **Interfaces:** overview, Locomotion, Manipulation, System control, Social interaction, Evaluation of VR Systems, **Applications:** Medical, Military, Robotics, issues and challenges in virtual reality.

Text Books:
1. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007
2. Anad R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

Suggested Reading:
1. George Mather, "Foundations of Sensation and Perception:Psychology", Press; 2 edition, 2009.
2. Peter Shirley, Michael Ashikhmin, and Steve Marschner, "Fundamentals of Computer Graphics", A K Peters/CRC Press; 3 edition, 2009.

Online Resources:
1. http://msl.cs.uiuc.edu/vr/

16CSO 06

FUNDAMENTALS OF DBMS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: File Structures.

Course Objectives: The main objectives of this course are:
1. To learn data models, conceptualize and depict a database system using E-R diagram.
2. To understand the internal storage structures in a physical DB design.
3. To know the fundamental concepts of transaction processing techniques.

Course Outcomes: On Successful completion of this course, student will be able to:
1. Understand the find fundamental components of the DBMS.
2. Design the database schema and develop E-R model.
3. Devise queries using relational algebra and SQL.
4. Apply normalization techniques and solve problems using various Indexing techniques.
5. Understand transaction processing, Concurrency control and recovery techniques.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	1	-	-	--	-	-	-	-	-	1	2
2	3	3	3	1	-	-	-	-	-	-	-	-	1	2
3	2	2	3	1	-	-	-	-	-	--	-	-	1	2
4	1	3	2	2	-	-	-	-	-	-	-	-	1	2
5	3	1	2	1	-	2	-	1	-	-	-	-	1	2

UNIT - I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures. **Database Design and E-R Model:** Basic concepts, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations. **Structured Query Language:** Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT - III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT - IV

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files. **Transaction Management:** Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT - V

Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery, **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, “An Introduction to Database Systems”, Eight Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, Johnnes Gehrke, “Database Management Systems”, Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, “Fundamentals of Database Systems”, Fourth Edition, Pearson Education,2006.

16CSO 07

BASICS OF CYBER SECURITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives: The main objectives of this course are:

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Course Outcomes: On Successful completion of this course, student will be able to

1. Discuss different types of cybercrimes and analyze legal frameworks to deal with these cybercrimes.
2. Describe Tools used in cybercrimes and laws governing cyberspace.
3. Analyze and resolve cyber security issues.
4. Recognize the importance of digital evidence in prosecution.
5. Analyze the commercial activities in the event of significant information security incidents in the Organization.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	1	3	1	1	1	-	-	2	-	1
2	3	2	2	3	3	2	1	2	2	1	-	2	-	2
3	2	3	1	3	3	3	1	2	3	2	2	3	-	1
4	2	2	1	3	3	3	1	2	3	2	1	2	-	1
5	2	3	2	3	3	2	1	2	3	2	2	3	-	1

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector.

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives**:** Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Sunit Belpre and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, Incident Response and computer forensics, Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, “Cyber Security and Cyber Laws”, Paperback – 2018.
2. Mark F Grady, Fransesco Parisi, “The Law and Economics of Cyber Security”, Cambridge university press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

16CSO 08

OPEN SOURCE TECHNOLOGIES
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Familiarity with Open Source Technologies.
2. Examples of OSS Projects, Advantages of Open Source.
3. Understand the principles, methodologies of OSS.
4. Understand the policies, licensing procedures and ethics of OSS.

Course Outcomes: On Successful completion of this course, student will be able to
1. Differentiate between Open Source and Proprietary software and Licensing.
2. Recognize the applications, benefits and features of Open Source Technologies.
3. Understand and demonstrate Version Control System along with its commands.
4. Gain knowledge to start, manage open source projects.
5. Understand and practice the Open Source Ethics.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	2	2	2	-	-	-	2	1	1	1	3
2	2	2	3	3	2	2	1	1	1	1	2	2	1	3
3	3	3	3	3	3	3	1	-	2	2	3	1	2	3
4	3	3	3	2	3	3	2	2	2	3	2	3	1	3
5	3	3	2	2	2	2	2	3	1	2	2	2	1	3

UNIT – I

Introduction to Open Source: Open Source, need of Open Source, Open Source Principles, Open Source Standards Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Software Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT – II

Fault Tolerant Design: **Principles and Open Source Methodology**- History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copyleft, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT – III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, Libre Office.

UNIT – IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media, What Is A License, How to create your own Licenses. Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT – V

Open Source Ethics- Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:

1. Kailash Vadera, Bjhavesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press.

Suggested Reading:

1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, "Perspectives on Free and Open Source Software", MIT press.

16CSO 09

BASICS OF ARTIFICIAL INTELLIGENCE
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basic Mathematics.

Course Objectives: The main objectives of this course are:

1. Provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Differentiate between a rudimentary Problem and an AI problem, it's Characteristics and problem-solving Techniques.
2. Compare and contrast the various knowledge representation schemes of AI.
3. Understand and analyze the various reasoning and planning techniques involved in solving AI problems.
4. Understand the different learning techniques.
5. Apply the AI techniques to solve the real-world problems.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	1	-	-	-	-	-	-	-	-	2	1
2	3	2	2	1		-	-	-	-	-		-	-	2
3	3	2	2	2	-	-	-	-	-	-	-	-	-	-
4	3	2	3	1	-	-	-	-	-	-	-	1	-	-
5	3	3	2	2	1	-	-	-	--	-	-	2	-	-

UNIT - I

Introduction: Definition, history, applications. **Problem Solving:** AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate–and–test, Hill Climbing, Constraint Satisfaction.

UNIT - II

Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification. **Knowledge Representation (Structured):** Declarative representation, Semantic nets, procedural representation, frames.

UNIT - III

Reasoning: Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory. **Planning:** Components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT - IV

Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: Decision tree. **Intelligent Agents:** Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - V

Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition. **Perception and Action:** Real Time Search, Vision, Speech Recognition, ACTION: Navigation, Manipulation, Robot architectures.

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, "Artificial Intelligence", 3rd Edition, 2008
2. Russell Norvig, "Artificial Intelligence-Modern Approach", 3rd edition, 2010.

Suggested Reading:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2012.
2. Nelson M. Mattos, "An Approach to Knowledge Base Management", Springer Berlin Heidelberg, 1991.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

16CSO 10

MACHINE LEARNING USING PYTHON
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Get an idea of Machine Learning algorithms to solve real world problems.
2. Study various machine learning algorithms.
3. Analyze data using machine learning techniques.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics concepts of Machine Learning and Python.
2. Apply feature engineering techniques and visualization tools to the data.
3. Analyze the various types of data by using python based machine learning techniques.
4. Identify and evaluate various recommender systems.
5. Design solutions to real world problems using deep learning algorithms.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	1	-	-	1	1	1	-	1	2	1	2
2	2	1	1	-	1	1	1	1	1	1	-	1	2	1	2
3	2	3	1	1	2	-	-	1	2	2	1	2	2	2	2
4	2	2	1	1	2	-	-	1	1	1	1	2	2	2	2
5	2	2	2	1	2	1	1	2	2	2	1	2	3	2	3

UNIT - I

Introduction to Machine Learning: Introduction, Machine Learning process. **Introduction to Python**: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT - II

Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python. **Data Visualization:** Various charts, histograms, plots.

UNIT - III

Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression. **Classification:** Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes.

UNIT - IV

Unsupervised Learning: Clustering, K-Means clustering, Hierarchical clustering. **Text Analysis:** Basic text analysis with Python, regular expressions, NLP, text classification. **Time Series Analysis**: Date and time handling, window functions, correlation, time series forecasting.

UNIT - V

Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework. **Recommender System:** Recommendation engines, collaborative filtering.

Text Books:
1. Abhishek Vijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018
2. Tom Mitchel "Machine Learning", Tata McGraWHill, 2017
3. Reema Thareja "Python Programming", Oxford Press, 2017.

Suggested Reading:
1. Yuxi Liu, "Python Machine Learning by Example", 2nd Edition, PACT, 2017

Online Resources:
1. https://www.guru99.com/machine-learning-tutorial.html
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Scheme of Instruction and Syllabus of

M. Tech (CSE)

(With effect from 2020-21)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (Autonomous)

Affiliated to Osmania University,

Hyderabad – 500 075, Telangana State

Institute Vision:

1. To be a centre of Excellence in Technical Education and Research.

Institute Mission:

To address the emerging needs through quality technical education and advanced research.

Department Vision:

To become a center of excellence in the field of Computer Science and Engineering that produces innovative, skillful, socially responsible and ethical professionals.

Department Mission:

1. To provide a curriculum that balances engineering fundamentals, modern technologies and research.
2. To provide opportunities for solving real world problems.
3. To provide opportunities for overall personal and social skill development.

M.Tech (CSE) Program Educational Objectives (PEO's)

1. Will be able to practice their profession with confidence and global competitiveness by making intellectual contributions.
2. Will pursue a life-long career of personal and professional growth with superior work ethics and character.
3. Will be engaged in research leading to innovations/products or become a successful entrepreneur.

M.Tech (CSE) Program Outcomes (PO's)

At the end of the program, students will be able to:

1. Apply the principles of Computer Science and Engineering to the appropriate problems
2. Investigate, analyze and formulate solutions to the complex real world problems
3. Demonstrate the use of modern tools and techniques in the field of Computer Science
4. Work with multidisciplinary groups in a collaborative manner to develop sustainable inclusive technologies
5. Communicate effectively and develop self-confidence and life-long learning

6 Able to possess leadership, project management and financial skills with professional ethics

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
M.TECH (CSE)
SCHEME OF INSTRUCTION &EXAMINATIONS

SEMESTER–I

S.No	Course Code	Title Of Course	Scheme Of Instructions Hours Per Week			Duration Of SEE In Hours	Scheme Of Examination Maximum Marks		Credits
			L	T	P/D		CIE	SEE	
		THEORY							
1	20CSC 101	Mathematical Foundation of Computer Science	3	-	-	3	40	60	3
2	20CSC 102	Advanced Data Structures	3	-	-	3	40	60	3
3	20CSEXXX	Elective -I	3	-	-	3	40	60	3
4	20CSEXXX	Elective -II	3	-	-	3	40	60	3
5	20MEC 103	Research Methodology and IPR	2	-	-	2	40	60	2
6	20XXXXXX	Audit Courses-1	2	-	-	2	-	50	Non Credit
		PRACTICAL							
7	20CSC 103	Laboratory 1 (Advanced Data Structures)	-	-	4	-	50	-	2
8	20CSEXXX	Laboratory 2 (Based on Elective-I,III)	-	-	4	-	50	-	2
		Total	**16**	**-**	**8**	**-**	**300**	**350**	**18**

L: Lecture **T**: Tutorial **D**: Drawing **P**: Practical
CIE - Continuous Internal Evaluation **SEE** - Semester End Examination

ELECTIVE-I,III		
S.No	**Course Code**	**Title Of Course**
1	20CSE101	Machine Learning
2	20CSE102	Internet of Things
3	20CSE103	Introduction to Intelligent Systems
4	20CSE104	Data Preparation and Analysis
5	20CSE105	Secure Software Design & Enterprise Computing (SSDEC)
6	20CSE106	Computer Vision

ELECTIVE -I ,III LAB		
S.No	**Course Code**	**Title Of Course**
1	20CSE107	Machine Learning Lab
2	20CSE108	Internet of Things Lab
3	20CSE109	Introduction to Intelligent Systems Lab
4	20CSE110	Data Preparation and Analysis Lab
5	20CSE111	SSDE Lab
6	20CSE112	Computer Vision Lab

ELECTIVE –II,IV,V		
S.No	**Course Code**	**Title Of Course**
1	20CSE113	Data Science & Big Data Analytics
2	20CSE114	Distributed Database Systems
3	20CSE115	Advanced Wireless and Mobile Networks
4	20CSE116	Human and Computer Interaction
5	20CSE117	GPU Computing
6	20CSE118	Digital Forensics
7	20CSE119	Mobile Applications and Services
8	20CSE120	Compiler for HPC
9	20CSE121	Open Source Technologies

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SCHEME OF INSTRUCTION &EXAMINATIONS

II-SEMESTER

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination		
							Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	20CSC 104	Advanced Algorithms	3	-	-	3	40	60	3
2	20CSC 105	Soft Computing	3	-	-	3	40	60	3
3	20CSEXXX	Elective -III	3	-	-	3	40	60	3
4	20CSEXXX	Elective -IV	3	-	-	3	40	60	3
5	20XXXXXX	Audit Course 2	2	-	-	2	-	50	Non Credit
PRACTICAL									
7	20CSC 106	Laboratory 3 (AA& Soft Computing)	-	-	4	-	50	-	2
8	20CSEXXX	Laboratory 4 (Based on Electives-III)	-	-	4	-	50	-	2
9	20CSC 107	Mini Projects with seminar	-	-	4	-	50	-	2
TOTAL			**14**	**-**	**12**	**-**	**310**	**290**	**18**

- Students be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break.

List of Audit Courses -1&2

S.No	Course Code	Title Of Course
1	20EGA101	English for research paper writing
2	20CEA101	Disaster mitigation and management
3	20EEA101	Sanskrit for technical knowledge
4	20ECA101	Value education
5	20EGA102	Indian constitution & fundamental rights
6	20ITA101	Pedagogy studies
7	20EGA103	Stress Management by Yoga
8	20EGA104	Personality Development through Life Enlightenment Skills.

III-SEMESTER

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination		
							Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	20CSEXXX	Elective -V	3	-	-	3	40	60	3
2	20CSXXX	Open Elective	3	-	-	3	40	60	3
3	20CSC 108	Dissertation Phase – I	-	-	20	-	100	-	10
TOTAL			**6**	**-**	**20**	**-**	**180**	**120**	**16**

ELECTIVE-V		
S.No	**Course Code**	**Title Of Course**
1	20CSE119	Mobile Applications and Services
2	20CSE120	Compiler for HPC
3	20CSE121	Open Source Technologies
4	NPTEL	Software Project Management
		Natural Language Processing
		Block Chain Architecture Design and Use cases
		Social Networks
		Virtual Reality

Open ELECTIVE -VI		
S.No	**Course Code**	**Title Of Course**
1	20CSO 101	Business Analytics
2	20MEO 101	Industrial Safety
3	20MEO 102	Introduction to Optimization Techniques
4	20CEO101	Cost Management of Engineering Projects
5	20MEO103	Composite Materials
6	20EEO101	Waste to Energy
7	20PYO 01	History of Science and Technology

****Students going for Internship / Industrial project, may complete these courses through NPTEL/ MOOCs**

IV-SEMESTER

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week			Duration of SEE in Hours	Scheme of Examination		
							Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	20CSC 109	Dissertation Phase – II	0	0	32	3	100	100	16
TOTAL			**0**	**0**	**32**	**-**	**100**	**100**	**16**

SEMESTER-I

20CSC 101

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Prerequisites: UG level Course in Discrete Mathematics.

Course Objectives: The objectives of this course are

1. Gain knowledge in discrete and continuous probability and its applications.
2. Use Graph theory for solving real world problems.
3. Solve problems using counting technique.

Course Outcomes: On Successful completion of the course, students will be able to

1. Solve the probability function by inequalities.
2. Infer the data by hypothesis testing procedure.
3. Apply graphs models in real time applications.
4. Apply various counting techniques in solving combinatorial problems.
5. Design solutions using Recurrence Relations for real time problems.
6. Apply number theory to cryptography problems.

UNIT-I

Fundamentals: Probability mass, Density, Cumulative Distribution functions, Parametric families of distributions, Expected value, Variance, Conditional Expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov Chains.

UNIT-II

Statistical Inference: Introduction, Parameter Estimation, Hypothesis Testing, Least squares curve fitting, The Coefficients of Determination Confidence Intervals in Linear Regression, Trend Detection and Slope Estimation, Correlation Analysis.

UNIT-III

Graphs: Graphs and Graph Models, Special Types of Graphs, Applications of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest Path Problems, Planar Graphs, Graph Coloring, Applications of Graph Colorings, Spanning Trees.

UNIT-IV

Counting: Basics of Counting, the Pigeon hole Principle, Permutations and Combinations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients.

Advanced Counting Techniques: recurrence Relations, Solving Linear Recurrence Relations, Divide and Conquer Algorithms, Generating functions, Inclusion-Exclusion, Applications of Inclusion – Exclusion

UNIT-V

Number theory and cryptography: Fundamental algorithms involving numbers, cryptography computations, information security algorithms and protocols. Computer Science and Engineering Applications: HMM, Routing algorithms, Bayes Theorem.

Textbooks:

1. Kishor S. Trivedi, "Probability & Statistics with Reliability. Queuing, and Computer Science Applications", 2ndEdition, John Wiley and Sons Ltd.2016.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications with Combinatorics and Graph Theory", 7thEdition, McGraw Hill Education (India) Private Limited, 2011.
3. M.T Goodrich, R.Tomasia, "Algorithm design- Foundations, analysis", and Internet algorithms, John Wiley,2002 .

Suggested Readings:

1. D.S. Malik and M.K. Sen., "Discrete Mathematics, Theory and Applications", Revised Edition, Cengage Learning, 2012.
2. Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Academic Press, 2012.
3. Douglas B. West, "Introduction to Graph Theory, 2ndEdition", PHI.2015.
4. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists & Mathematicians", 2nd Edition, Pearson Education, 1985.

Online Resources:

1. http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

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20CSC 102

ADVANCED DATA STRUCTURES

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Prerequisites: Undergraduate Course in Data Structures.

Course Objectives: The objectives of this course are

1. To use appropriate data structures and to design algorithms for a specific problem.
2. To analyze and implement dictionaries, hash algorithms skip list data structures as solutions to real-world problems.
3. To deal with text-processing algorithms and computational geometric concepts for efficient space utilization.

Course Outcomes: On Successful completion of the course, students will be able to

1. Analyze the significance of Dictionaries and apply them to solve real-world problems.
2. Apply various hashing techniques to perform linear and quadratic probing.
3. Construct Skip Lists in a randomized and deterministic way.
4. Develop algorithms for various tree data structures like red-black trees, B-trees and Splay trees.
5. Apply the text processing operations for efficient space utilization.
6. Analyze computational geometric problems in terms of priority and range search operations.

UNIT-I

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation ofDictionaries; **Hashing**: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing, Recent trends in hashing.

UNIT-II

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search andUpdate Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.

UNIT-III

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B- Trees,Splay Trees.

UNIT-IV

Text Processing: String Operations, Brute-Force Pattern Matching, The BoyerMoore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman coding algorithm.

UNIT-V

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad-trees, k-D Trees.

Textbooks:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in JAVA", 3rd Edition, Pearson,2004.
2. M T Goodrich and Roberto Tamassia, Algorithm Design, John Wiley, 2002.

Suggested Readings:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++, 2ndEdition", Pearson, 2004.
2. SartajSahni, "Data structures, Algorithms and Applications in Java", 2ndEdition, Universities Press, 2005.

Online Resources:

1. https://www.cise.ufl.edu/~sahni/cop3530/presentations.htm.
2. http://www.nptelvideos.com/java

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20CSE101

MACHINE LEARNING

Elective-I

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-requisites:UG level course in probability, linear algebra and calculus. Any Programming experience is essential.

Course objectives: The objectives of this course are

1. Introduce students to state-of-the-art methods.
2. Expose to Modern programming tools for data analysis.
3. To study various sampling and classification problems

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify complexity of Machine Learning algorithms and their limitations.
2. Recognize the underlying mathematical relationships within and across Machine Learning algorithms and their paradigms.
3. Design and implement machine learning solutions to classification, regression, and clustering problems.
4. Evaluate and interpret the results of the algorithms.
5. Develop an appreciation for what is involved in learning from data.
6. Apply graphical models for probabilistic reasoning.

UNIT-I

Introduction: Learning, Types of Machine Learning.Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm.Learning with Trees: Constructing Decision Trees, CART, Classification Example.

UNIT-II

Linear Discriminants: The Perceptron, Linear Separability, Linear Regression.
Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices,Deriving back Propagation
SUPPORT Vector Machines: Optimal Separation, Kernels.

UNIT-III

Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison.

UNIT-IV

Evolutionary Learning: Genetic Algorithms, Genetic Operators, Genetic Programming.
Ensemble learning: Boosting, Bagging, Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis.

UNIT-V

Graphical Models: Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm.. Reinforcement Learning - The Learning Task, Q Learning.

Textbooks:

1. Tom M. Mitchell, "Machine Learning", Mc Graw Hill, 1997
2. Stephen Marsland, Machine Learning - An Algorithmic Perspective, CRC Press, 2009.

Suggested Readings:

1. Margaret H Dunham, "Data Mining", Pearson Edition., 2003.
2. GalitShmueli, Nitin R Patel, Peter C Bruce, "Data Mining for Business Intelligence", Wiley India Edition, 2007
3. RajjanShinghal, "Pattern Recognition", Oxford University Press, 2006.

Online resources:

1. NPTEL https://nptel.ac.in/courses/106106139/.

20CSE102

INTERNET OF THINGS

Elective-I

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are
1. Identify the vision and understand the basics of IoT.
2. To explore the use of Devices, Gateways in IoT and understand IoT protocols.
3. To introduce Node MCU, Raspberry Pi platform and Explore Industrial Automation, and Commercial Building Automation in IoT.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand an overview of IoT.
2. Use of devices and gateways in Service Oriented Architecture.
3. Analyze various communication protocols in sensor networks.
4. Design applications using Raspberry Pi and Node MCU.
5. Develop different IoT Automation Systems.
6. Apply IoT concepts in various domains such as Smart Cities, Home Automation, Weather Monitoring System, and Agriculture.

UNIT-I

Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators andTypes of Actuators.

Basics of Networking : IoT components, Functional Components of IoT, IoTinterdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

UNIT-II

Communication Protocols: 6LoWPAN, 6LoWPAN Routing Considerations,Loading Routing, RPL Routing, RFID, Functionality-based IoT Protocol Organization: MQTT, SMQTT, CoAP, XMPP, AQMP, Zigbee, Wireless HART, Z-Wave, Bluetooth, NFC, RFID.

UNIT-III

Sensor Networks: Target Tracking, Wireless Multimedia Sensor Networks(WMSNs), Nano networks, Underwater Acoustic Sensor Networks, Opportunistic localization, WSN Coverage, Stationary Wireless Sensor Networks, Mobile Wireless Sensor Networks, Delay Tolerant Networks, UAV Networks, FANETs: Flying Ad Hoc Networks, VANETs, Machine-to-Machine Communications, Interoperability in IoT, Introduction to SDN: SDN for IoT , Recent advances in IoT.

UNIT-IV

Introduction to Node MCU: Node MCU pin diagram, Integration of Sensors andActuators with Node MCU.

Introduction to Raspberry Pi: About the board, Linux on Raspberry Pi, RaspberryPi Interfaces, Programming Raspberry Pi with Python.

UNIT-V

IoT Systems: A Case Study.

Home Automation: Smart Lighting, Home Intrusion Detection , Smart Cities:
Smart Parking Environment: Weather Monitoring System, Weather Reporting
Bot, Air Pollution Monitoring, Forest Fire Detection, Agriculture: Smart Irrigation.

Textbooks:

1. Raj and Anupama C. Raman," The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. ArshdeepBahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

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Suggested Readings:

1. Dr. SRN Reddy, RachitTirnkral and Manasi Mishra, “Introduction to Internet of Things: A practical Approach”, ETI Labs, 2018.
2. Adrian McEwen, “Designing the Internet of Things”, Wiley, 2013.
3. Raj Kamal, “Internet of Things:Architecture and Design”, McGraw Hill, 2017.
4. CunoPfister, “Getting Started with the Internet of Things”, 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, “Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers, Series in Communications, 2013.

Online Resources :

1. Li Da Xu, Wu He, and Shancang Li, “Internet of Things in Industries: A Survey “, IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik , JP. Vasseur, R. Alexander, “RPL: IPv6 Routing Protocol for LowPower and Lossy Networks”, IETF, Standards Track, Mar. 2012.
3. Z. Shelby , K. Hartke, C. Bormann, “The Constrained Application Protocol (CoAP)”,Internet Engineering Task Force (IETF), Standards Track, 2014.
4. L.Fenzel, “What’s The Difference Between IEEE 802.15.4 And ZigBee Wireless?”,Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, “Information theoretic self-management of Wireless Sensor Networks”, Proceedings of NCC 2013.
6. F. Luo et al., “A Distributed Gateway Selection Algorithm for UAV Networks,” in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22-33, March 2015.

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20CSE103

INTRODUCTION TO INTELLIGENT SYSTEMS

Elective-I

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-Requisites:UG level Course in Data Structures, Data Management, Probability and Statistics.

Course Objectives: The objectives of this course are

1. Understand the different learning techniques of AI systems.
2. Learn different knowledge representation techniques.
3. Developing systems to demonstrate intelligent behavior dealing with uncertainty.

Course Outcomes: On Successful completion of the course, students will be able to

1. Describe knowledge of the fundamental principles of intelligent systems.
2. Identify various search strategies to solve problems.
3. Compare and contrast knowledge representation schemes.
4. Appraise knowledge in Uncertainty and Probabilistic reasoning approaches.
5. Apply different learning techniques to solve complex problems.
6. Define the basic concepts of phases and applications of Natural Language processing.

UNIT-I

Introduction: History Intelligent Systems, Foundations of Artificial Intelligence, Sub areas of Al, Applications.
Problem Solving - State - Space Search and Control Strategies: Introduction, General Problem Solving Characteristics of problem, Exhaustive Searches, Heuristic Search Techniques, Iterative - Deepening A*, Constraint Satisfaction. Game Playing, Bounded Look - Ahead Strategy and use of Evaluation Functions, Alpha Beta Pruning.

UNIT-II

Logic Concepts and Logic Programming: Introduction, Propositional Calculus Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau, A System in Propositional Logic, Resolution refutation in Propositional Logic, Predicate Logic, Logic Programming.
Knowledge Representation: Introduction, Approaches to knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT-III

Expert System and Applications: Introduction, Phases in Building Expert Systems Expert System Architecture, Expert Systems Vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and tools. Uncertainty Measure - Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Certainity Factor Theory, Dempster - Shafer Theory.

UNIT-IV

Machine - Learning Paradigms: Introduction, Machine learning System, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees, Deductive Learning, Clustering, Support Vector Machines.
Intelligent Agents: Agents vs Software programs, classification of agents, Multi-agent systems, Architecture of intelligent agents, Multi-agent application.

UNIT-V

Advanced Knowledge Representation Techniques: Case Grammars, SemanticWeb.
Natural Language Processing: Introduction, Sentence Analysis Phases,Grammars and Parsers, Types of Parsers, Semantic Analysis, Universal Networking Knowledge.

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Text Books:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, First Edition, 2011.
2. Russell, Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Edition, 2004.
3. Rich, Knight, Nair , Artificial Intelligence, Tata McGraw Hill, 3rd Edition 2009.

Online Resources :

1. http://www.vssut.ac.in/lecture_notes/lecture1428643004.pdf.
2. http://www.cs.toronto.edu/~fbacchus/csc384/Lecture Hours/Lecture Hours.html.
3. https://nptel.ac.in/courses/106105077/.

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20CSE104

DATA PREPARATION AND ANALYSIS

Elective-III

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Course Objectives:

1. Identify data gathering and preparation techniques for industrial and scientific applications.
2. Apply exploratory data analysis techniques to develop meaningful data visualizations.
3. Analyze various statistical significance based testing mechanisms and apply them to deal with real-world problems.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and analyze various data gathering and preparation techniques to format, parse and transform data as required.
2. Apply data cleaning techniques on various data sets to perform consistency check, transformation, and segmentation processes.
3. Apply exploratory data analysis techniques to perform descriptive and comparative statistics on data.
4. Analyze different visualization techniques and apply the suitable one to deal with real-world problems.
5. Apply correlations, connectivity, and interactivity techniques on different data items for any given dataset.
6. Analyze various statistical significance based testing mechanisms and apply them to build regression models.

UNIT-I

Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real-time issues.

UNIT-II

Data Cleaning: Consistency checking, Heterogeneous and missing data, DataTransformation and segmentation.

UNIT-III

Exploratory Analysis: Descriptive and comparative statistics, Clustering andassociation, Hypothesis generation.

UNIT-IV

Visualization: Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity.

UNIT-V

Statistical Significance, ANOVA, T-test, Building machine learning Regression models.

Textbooks:

1. Making sense of Data : "A practical Guide to Exploratory Data Analysis and Data Mining", by Glenn J. Myatt, 2007.
2. Trochim, W. M. K. “Data Preparation” Research Methods Knowledge Base 2nd Edition. Accessed 2/24/09.

Suggested Readings:

1. The visual display of quantitative information by edwardtufte, 2001.
2. "Visualizing Data:" Exploring and Explaining Data with the Processing Environment, by Ben Fry, 2008
3. Exploratory data Mining and data cleaning, by Tamraparnidasu, 2003.

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Online Resources :

1. https://www.safaribooksonline.com/library/view/visualizingdata/9780596514556/ch08.html.
2. https://www.scribd.com/document/54993779/Making-Sense-of-Dataa-Practical-Guide-to-Exploratory-Data-Analysis-and-Data-Mining.

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20CSE105

SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING

Elective-III

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-Requisites :UG level course in Computer Programming, Software Engineering.

Course Objectives:
1. To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic.
2. Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
3. Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

Course Outcomes: After completion of course, students would be able to:
1. Differentiate various software vulnerabilities and develop software to process vulnerabilities for an organization.
2. Evaluate various enterprise application design and development tools and standard practices.
3. Review techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
4. Know essential techniques for reducing and avoiding system and software security Problems.
5. Understand methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.
6. Solve enterprise scale problems emanating from lapses in security requirements and information system management practices.

UNIT-I

Secure Software Design : Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

UNIT-II

Enterprise Application Development : Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

UNIT-III

Enterprise Systems Administration : Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/ DHCP/Terminal Services/Clustering/Web/Email).

UNIT-IV

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

UNIT-V

Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

Textbooks:
1. Theodor Richardson, Charles N Thies, "Secure Software Design", Jones & Bartlett, 2012.
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley, 2015 E book.

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Online Resources :

1. https://www.coursera.org/specializations/secure-software-design.

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20CSE106

COMPUTER VISION

Elective-III

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre Requisites: UG level Course in Linear Algebra and Probability.

Course Objectives: The objectives of this course are
1. To understand the Fundamental Concepts Related To Multi-Dimensional Signal Processing.
2. To understand Feature Extraction algorithms.
3. To understand Visual Geometric Modeling and Stochastic Optimization.

Course Outcomes: On Successful completion of the course, students will be able to
1. Explain the basic principles of image processing and its significance in real world.
2. Interpret and evaluate various approaches for image. transformation, segmentation, and restoration.
3. Choose object, scene recognition and categorization algorithms for real time images.
4. Analyze images and videos for problems such as tracking and structure from motion.
5. Explain recovery of 3D structure of ill-posed scenes.
6. Apply various techniques to build computer vision applications.

UNIT-I

Image Formation and Description: Fundamental steps of image processing, theimage model and Image acquisition, Sampling and quantization, Relationship between pixels. Sampling & Quantization, Elements of Digital Image Processing Systems.
Image Transforms: Digital Image Transforms - Fourier Transform, Extension to 2D.Properites of Fourier transformations.

UNIT-II

Image Enhancements: Histogram Equalization, Image Smoothing, ImageSharpening, Edge Detection.
Segmentation: Active contours, Split and merge, Mean shift and mode finding,
Normalized cuts.
Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation.

UNIT-III

Structure from motion: Triangulation, Two-frame structure from motion,Factorization, Bundle adjustment, constrained structure and motion
Dense motion estimation: Translational alignment, parametric motion, Spline-based motion, Optical flow, Layered motion.

UNIT-IV

Recognition: Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding.

UNIT-V

3D Reconstruction: Shape from X, Active range finding, Surface representations, Point-based representations, Volumetric representations, Model-based reconstruction.

Textbooks:
1. R. C. Gonzalez and R. E. Woods “Digital Image Processing” Addison Wesley 2008.
2. Richard Szeliski “Computer Vision: Algorithms and Applications” Springer-Verlag London Limited 2011.

Suggested Readings:
1. “Pattern Recognition: Statistical. Structural and Neural Approaches”; Robert J. Schallkoff; John Wiley and Sons; 1992.
2. “Computer Vision: A Modern Approach”; D. A. Forsyth and J. Ponce; Pearson Education; 2003.

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3. "Multiple View geometry". R. Hartley and A. "Zisserman. 2002 Cambridge university Press".
4. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
5. K. Fukunaga; "Introduction to Statistical Pattern Recognition", Second Edition, Academic Press, Morgan Kaufmann, 1990.

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc18_ee40.
2. CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline.
3. Computer Vision Homepage: http://www2.cs.cmu.edu/afs/cs/project/ cil/ftp/ html/vision.html.

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20CSE113

DATA SCIENCE AND BIG DATA ANALYTICS

Elective-II

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Prerequisites: UG level Course in Database Management Systems.

Course Objectives: The objectives of this course are

1. Acquire knowledge and expertise to become a proficient data scientist.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
3. Evaluate data visualization techniques to deal with various design aspects.

Course Outcomes: On Successful completion of the course, students will be able to

1. Understand and explore big data Ecosystem using exploratory and statistical evaluation methods.
2. Analyze various machine learning algorithms and apply them to solve real-world problems.
3. Apply advanced analytical tools to perform logistic regression through experiments and extract meaningful data.
4. Apply data visualization techniques to evaluate models and to overcome data leakage problems.
5. Understand and apply Hadoop Ecosystem to explore bigdata analytics using Map-reduce techniques.
6. Analyze the significance of NoSQL database systems and apply them to perform bigdata analysis.

UNIT-I

Introduction: Big Data and Data Science Hype, History of past and current, AData Science Profile, Meta-Definition, Statistical Thinking, Exploratory Data Analysis, The Data Science Process.

UNIT-II

Algorithms: Machine Learning Algorithms, Three Basic Algorithms

Spam Filters, Naive Bayes, and Wrangling: Learning by Example, Naive Bayes,Laplace Smoothing, Comparing Naive Bayes to KNN.

UNIT-III

Logistic Regression: Thought Experiments, Classifiers, M6D LogisticRegression.

Extracting Meaning from Data: William Cukierski, The Kaggle Model, EthicalImplications of a Robo-Grader, Feature Selection, Google's Hybrid Approach to Social Research.

UNIT-IV

Data Visualization Techniques: Data Visualization History, Types of Visualization,Characteristics, Encoding schemes, Mapping variables to encodings, Visual encodings.

Data Leakage and Model Evaluation: Claudia's Data Scientist Profile, Data Mining Competitions, Characteristics of Good Modeler, Data Leakage, Avoid Leakage, Evaluating Mode.

UNIT-V

Introduction to Big Data: Defining big data, 4 V's of big data, Big data types,Analytics, Examples obig data, Big data and Data Risk, Big data technologies, The benefits of big data, Crowd sourcing analytics. Architecture of Apache Hadoop HDFS, **No SQL Data Management:** Types of NOSQL data bases Benefits of NO SQL, **Map Reduce:** Introduction, Map reduce example, Job Tracker, Map .

Textbooks:

1. Cathy O'Neil and Rachel Schutt, Doing Data Science, Straight Talk From The Frontline, O'Reilly, 2014.
2. "Big Data & Hadoop", V.K. Jain, Khanna Publishing House, 2017.

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Suggested Readings:

1. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. "Mining of Massive Datasets", v2.1, Cambridge UniversityPress, 2014.
2. Foster Provost and Tom Fawcett, Data Science for Business, What You Need to Know about Data Mining and Data-Analytic Thinking, O'Reilly, 2013.
3. Samir Madhavan, "Mastering Python for Data Science, Packt Publishing, 2015.
4. "Big Data Black Book, DT Editorial Services," Wiley India
5. "Data Science & Analytics", V.K. Jain, Khanna Publishing House Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, ISBN: 978-93-86173454, 2018.
6. Montgomery, Douglas C. and George C. Runger, Applied statistics and probability for engineers. John Wiley & Sons, 6th edition, 2013.

Online Resources:

1. http://datasciencemasters.org.
2. http://learnds.com/
   https://www.datascienceweekly.org

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20CSE114

DISTRIBUTED DATABASE SYSTEMS

Elective-II

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are
1. Acquire insight into difference between the centralized databases and distributed databases.
2. Understand distributed DBMS architecture, query decomposition and data localization.
3. Learn the techniques of transaction management, distributed concurrency control, client/server architectures and distributed multi-DBMSs.

Course Outcomes: On Successful completion of the course, students will be able to
1. Differentiate key concepts and techniques for centralized. databases and distributed databases.
2. Analyze and design distributed database systems based on the principles of distributed indexing, query evaluation, data replication.
3. Implement storage, indexing, query evaluation and query optimization techniques.
4. Implement the concepts of transaction management, concurrency. control, crash recovery, deadlocks and catalog management.
5. Apply suitable architecture for distributed databases and concepts of inter-operability of databases.

UNIT-I

Introduction: Distributed data processing; what is a DDBS; Advantagesand disadvantages of DDBS.
Problem areas; Overview of database and computer network concepts,DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

UNIT-II

Distributed Database Design Alternative design strategies; Distributed design issues; Fragmentation; Data allocation SEMANTICS DATA CONTROL View management; Data security; Semantic Integrity Control
Query Processing Issues Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

UNIT-III

Distributed Query Optimization: Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms.
Transaction Management The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models
Concurrency Control Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.

UNIT-IV

Reliability issues in DDBSs: Types of failures; Reliability techniques; Commit protocols; Recovery protocols.

UNIT-V

Parallel Database Systems: Parallel architectures; parallel query processing and optimization; load balancing.
Advanced Topics: Mobile Databases, Distributed Object Management, Multi-databases.

Suggested Readings:

1. "Principles of Distributed Database Systems", M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.
2. "Distributed Database Systems", D. Bell and J. Grimson, Addison-Wesley, 1992.

20CSE115

ADVANCED WIRELESS AND MOBILE NETWORKS

Elective-II

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-requisites: Undergraduate course in Computer Networks.

Course Objectives:

1. Familiarity with the wireless/mobile market and the future needs and challenges.
2. Familiarity with key concepts of wireless networks, standards, technologies and their basic operations.
3. Learn how to design and analyze various medium accesses, evaluate MAC and network protocols using network simulation software tools.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify the knowledge of wireless networking and its standards.
2. Recognize different cellular technologies (like 3G, 4G, 5G) and WLAN, WPAN, WWAN for performance analysis.
3. Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
4. Analyze various wireless network transmission to build effective communication.
5. Relate Security techniques to resolve network vulnerabilities.
6. Develop mobile applications to solve some of the real-world problems.

UNIT-I

Introduction: Wireless Networking Trends, Key Wireless Physical LayerConcepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc.

Wireless Local Area Networks:

IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF & PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes.

UNIT-II

Wireless Cellular Networks: WLAN ,3G, 4G and 5G introduction,Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread spectrum Technologies.

UNIT-III

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview WIRELESS SENSOR NETWORKS Introduction, Application, Physical, MAC layer and Network Layer, Power Management.

UNIT-IV

WIRELESS PANs Bluetooth AND Zigbee, Introduction to Wireless Sensors.

Tiny OS Overview.

UNIT-V

Security: Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, QoS in wireless communication.

Textbooks:

1. Schiller J., "Mobile Communications," Addison Wesley 2000
2. Stallings W., "Wireless Communications and Networks", Pearson Education 2005

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Suggested Readings:

1. Stojmenic Ivan, "Handbook of Wireless Networks and Mobile Computing", John Wiley and Sons Inc 2002
2. Yi Bing Lin and ImrichChlamtac, "Wireless and Mobile Network Architectures", John Wiley and Sons Inc 2000
3. Pandya Raj, "Mobile and Personal Communications Systems and Services', PHI 20.

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20CSE116

HUMAN AND COMPUTER INTERACTION

Elective-IV

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are

1. Learn the foundations of Human Computer Interaction.
2. Be familiar with the design technologies for computer interaction and guidelines for web user interface.
3. Learn the ecosystem and tools of mobile Human Computer interaction.

Course Outcomes: On Successful completion of the course, students will be able to

1. Understand the structure of models and theories of human computer interaction.
2. Understand the vision of a computer user.
3. Understand the recognition and remembrance limitations of a computer user.
4. Understand the mobile ecosystem and use the corresponding tools for mobile design.
5. Design an interactive web interface on the basis of models studied.

UNIT-I

Foundations**:** The human, the computer, The Interaction, Paradigms

Introduction**:** Our perception is biased; our vision is optimized to see structure.

UNIT-II

We Seek and Use Visual Structure, Our Color Vision is Limited, Our Peripheral Vision is Poor, Reading is Unnatural, Our Attention is Limited; Our Memory is Imperfect, Limits on Attention Shape Our Thought and Action.

UNIT-III

Recognition is Easy, Recall is Hard, Problem Solving and Calculation are Hard, Many Factors Affect Learning, Human Decision Making is Rarely Rational.

UNIT-IV

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile
Applications: Widgets, Applications, Games- Mobile Information Architecture,
Mobile Design: Elements of Mobile Design, Tools.

UNIT-V

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow.Case Studies.

Textbooks:

1. "Designing with the Mind in Mind – Simple Guide to Understanding", 2nd edition, Jeff Johnson, Elsevier Inc., 2010.
2. "Human Computer Interaction", 3rd edition, Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, Pearson Education Limited, 2004.
3. Brian Fling, "Mobile Design and Development", First Edition , O Reilly Media Inc., 2009.
4. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O Reilly, 2009.

Suggested Readings:

1. "Designing the User Interface", 5th Edition, Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Pearson Education Limited, 2013.
2. "Mind Design II, 2nd Edition", Revised and enlarged edition, John Haugeland, The MIT Press, 1997.

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Online Resources :

1. https://nptel.ac.in/courses/106103115/
2. https://www.interaction-design.org/courses/human-computer-interaction?ad-set=human-computer-interactioncourse&gclid= EAIaIQobChMIkJu W09jM4QIVgTgrCh0PuwtXEAAYASAAEgLPhPD_BwE

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20CSE117

GPU COMPUTING

Elective-IV

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Prerequisites: UG level Course in Computer Graphics, Animation, ComputerVision, C Language.

Course Objectives:

1. To learn parallel programming with Graphics Processing Units (GPUs).
2. Understand and Identify key elements of computer graphics pipeline and GPU hardware.
3. Recognize the computing problems and implement optimization procedures that will benefit GPU computing.

Course Outcomes: On Successful completion of the course, students will be able to

1. List out CPU/GPU comparisons and identify the features of parallel programming.
2. Write simple programs using CUDA programming model.
3. Distinguish various memory hierarchies and carryout performance evaluation with different memories.
4. Illustrate synchronization concepts in CPU and GPU.
5. Point out advanced topics in multi-GPU processing and heterogeneous processing.
6. Develop programs using GPUs for real world problems in image processing, simulation and deep learning.

UNIT-I

Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs.Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel Programming

CUDA: CUDA Open CL / Open ACC, Hello World, Computation Kernels, Launchparameters, Thread hierarchy, Warps / Wave fronts, Thread blocks / Workgroups, **Streams:** Streaming multiprocessors, 1D / 2D /3D thread mapping, Deviceproperties, Simple Programs.

UNIT-II

Memory: Memory hierarchy, DRAM / global, local / shared, private / local,textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices,

Matrices: Programs with matrices, Performance evaluation with differentmemories.

UNIT-III

Synchronization: Memory Consistency, Barriers (local versus global), Atomics,Memory fence.

Prefix sum, Reduction, Synchronization across CPU and GPU Programs for concurrent Data Structures such as Work-lists, Linked-lists.

Functions: Device functions, Host functions, Kernels ,functions, Usinglibraries(such as Thrust), developing libraries.

UNIT-IV

Debugging GPU Programs: Profiling, Profile tools, Performance aspects **Streams:** Asynchronous processing, tasks, Task-dependence, Overlapped datatransfers, Default Stream, Synchronization with streams.

Events: Event-based-Synchronization - Overlapping data transfer and kernelexecution, pitfalls.

UNIT-V

Advanced topics: Dynamic parallelism, Multi-GPU processing, HeterogeneousProcessing.

Textbooks:

1. "CUDA Programming: A Developer's Guide to Parallel ComputingWith GPUs", Shane Cook, Morgan Kaufman, 2012 (ISBN: 978-0124159334)
2. "Programming Massively Parallel Processors: A Hands-on Approach",David Kirk, Wen-meiHwu, Morgan Kaufman, 2010 (ISBN: 978-0123814722).

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Suggested Readings:

1. "CUDA by Example: An Introduction to General Purpose GPU Programming; Jason Sanders, Edward Kandrot; Addison-Wesley; 2011(ISBN978-0-13-138768-3)
2. The CUDA Handbook: A Comprehensive Guide to GPU Programming";Nicholas Wilt; Addison Wesley; 2013(ISBN: 978-0321809469)

Online Resources :

1. CUDA C Programming Guide NVIDIA's Parallel Forall Blog
2. https://devblogs.nvidia.com/calibrating-videos-vrworks-360-video
3. Mapping from GPU name to Compute Capability.

20CSE118

DIGITAL FORENSICS

Elective-IV

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Prerequisites: UG level Course in Operating Systems, Computer Networks.

Course Objectives:
1. To provide basics of the rapidly changing and fascinating field of Digital forensics.
2. To collect, process, analyze and present computer forensic evidence.
3. To learn about network forensics, mobile forensics and Legal Aspects of Digital Forensics.

Course Outcomes: On Successful completion of the course, students will be able to
1. Explain the fundamentals of digital forensics.
2. Choose the methods for Collecting, preserving and recovering the evidence for use in investigations.
3. Explain the need to maintain the chain of evidence in criminal investigations and apply this in the context of simple case studies.
4. Analyze data acquired from various crime scene scenarios.
5. Describe the Legal Aspects of Digital Forensics.
6. Demonstrate the concept of Network Forensics and Mobile Forensics.

UNIT-I

Digital forensics fundamentals: Forensics science, digital forensics, Uses of Digital Forensics, The Digital Forensics Process, Use of Computer forensics in law Enforcement, Computer forensics assistance to Human resources/ employment proceeding, Computer forensics services, Benefits of professional forensics methodology.

UNIT-II

Data recovery: Data recovery defined, Data backup and data recovery, the role of backup in data recovery, Data recovery solution, Hiding and Recovering Hidden Data. Evidence collection and data seizure: Why collect evidence, Collection options, obstacles, Types of evidence, rules of evidence, Volatile evidence, general procedure, Collection and archiving, methods of collection, artifacts, Collection steps, controlling contamination: The chain of custody

UNIT-III

Duplication and preservation of digital evidence: Preserving the digital crime scene, Computer evidence processing steps, Legal aspects of collection and preserving Computer forensics evidence Computer image verification and authentication Special needs of evidential authentication, Practical consideration, implementation.

UNIT-IV

Computer Forensics Analysis - Discovery of electronic evidence, identification of data, reconstructing past events, Investigating Live Systems (Windows &UNIX).
Network forensics: Network Security Tools, Network Attacks, Network Evidence and Investigations.

UNIT-V

Mobile forensics: Collecting and Handling Cell Phones as Evidence, Cell Phone Forensic Tools.
Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

Textbooks:
1. John Vacca, "Computer Forensics: Computer Crime Scene Investigation", Laxmi Publications, First Edition 2015.
2. John Sammons, “The Basics of Digital Forensics”, The Primer for Getting Started in Digital Forensics, 2nd Edition, Syngress (2014).

3. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, TataMcGrawHill, 2006.

Suggested Readings:

1. Marjie T. Britz, “Computer Forensics and Cyber Crime An Introduction”, 3rd Edition, Pearson Education 2013.
2. Cory Altheide, Harlan Carvey, “Digital Forensics with Open Source Tools”, Elsevier Publications, 2011.
3. Brian Carrier, “File System Forensic Analysis”, Pearson Education, 2005.

Online Resources:

1. https://www.cs.nmt.edu/~df/lectures.html
2. http://www.cyberforensics.in/
3. https://www.ncdrc.res.in/

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20CSE119

MOBILE APPLICATIONS AND SERVICES

Elective-V

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-Requisites: UG level Course in Wireless Communication and MobileComputing.

Course Objectives: The objectives of this course are

1. This course presents the three main mobile platforms and their ecosystems, namely Android, iOS, and PhoneGap/WebOS.
2. It explores emerging technologies and tools used to design and implement feature-rich mobile applications for smart phones and tablets
3. It also take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile.

Course Outcomes : After completion of the course, students will be able to

1. Identify the target platform and users and be able to define and sketch a mobile application.
2. Design the User Interface for mobile applications.
3. Develop database management system to retrieve and/or store data for mobile application.
4. Analyze Android networking and Internet services use in Mobile Apps.
5. Illustrate the packaging and deploying mobile apps with performance best practices and location based services.
6. Evaluate the development process of mobile application with security concepts.

UNIT-I

Introduction: Introduction to Mobile Computing, Introduction to AndroidDevelopment Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User

UNIT-II

More on UIs: Voice UIs and Mobile Apps, Text-to-Speech Techniques, Designingthe Right UI, Multichannel and Multimodal UIs . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider.

UNIT-III

Communications via Network and the Web: State Machine, CorrectCommunications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms.

UNIT-IV

Putting It All Together: Packaging and Deploying, Performance Best Practices,Android Field Service App, Location Mobility and Location Based Services

UNIT-V

Platforms and Additional Issues: Development Process, Architecture, Design,Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions.

Textbook:

1. Wei-Meng Lee, "Beginning Android 4 Application Development", 2012 by John Wiley & Sons.

Suggested Readings:

1. Jeff Mc Wherter, "Scott Gowell, PROFESSIONAL Mobile Application Development", Wrox, 1 edition, 2012.
2. James C Sheusi, Android Application Development for Java Programmers, Cengage Learning, 2013.

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Online Resources:

1. https://nptel.ac.in/courses/106106147/6
2. https://nptel.ac.in/courses/106106156/30

20CSE120

COMPILER FOR HPC
Elective-V

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-Requisites :UG Level course in Data Structure, Compiler Design, Theory ofComputation.

Course Objectives:
1. To introduce the structure of compilers and high-performance compiler design to the field of Computer Science.
2. Analyze the basic steps involved in converting a source language to target code or target language.
3. Understands the concepts of cache coherence and parallel loops in compilers are included. Gain the knowledge to write a compiler program or can able to build a compiler.

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify the basic concepts needed for the development of a compiler structure of a compiler
2. Explore the concepts of Parallel loops, data dependency, exception handling and debugging in a compiler.
3. Interpret and analyze the concepts involved in loop structuring and concurrency analysis.
4. Differentiate the various types of Machines, and the techniques like Vector Code from Sequential Loops for all Loops, Round off Error, Exceptions, and Debuggers, Multi.
5. Elaborate the Message passing Machines and Scalable Shared Machines
6. Determine the recent trends in compilers for efficient compiler building.

UNIT-I

High-Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance, Compiler transformation for high performance computing.
Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph

UNIT-II

Scalar Analysis with Factored Use-Def Chains: Constructing Factored Use-Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays.Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis.

UNIT-III

Loop Restructuring: Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations.
Optimizing for Locality: Single Reference to Each Array, Multiple References,General Tiling, Fission and Fusion for Locality

UNIT-IV

Concurrency Analysis: Concurrency from Sequential Loops, Concurrency fromParallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers.

UNIT-V

Message -Passing Machines:, Remote Data Access, Automatic Data Layout, Multiple Array Assignments, Other Topics. Scalable Shared-Memory Machines: Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines. Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine, Nvidiacuda parallel computing.

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Textbooks:

1. Michael Wolfe, "High-Performance Compilers for Parallel Computing", Pearson, 2007.
2. "Compiler transformation for High performance computing" –DAVID F. BACON, SUSAN L, 1994.

Online Resources :

1. www.springer.com/gp/book/9783540280095
2. www.chpc.utah.edu/documentation/software/compilers.php
3. https ://www.aspsys.com/solutions/software-solutions/hpc-compilers
4. https://link.springer.com/book/10.1007%2fBFboo17241.

20CSE121

OPEN SOURCE TECHNOLOGIES

Elective-V

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are

1. Familiarity with Open Source Technologies
2. Study some FOSS Projects to under the principles, methodologies of FOSS.
3. Understand the policies, licensing procedures and ethics of FOSS.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify various OSS tools, platforms, licensing procedures, and development models, ethics
2. Describe various OSS projects, development models and project management
3. Adapt to the usage of OSS tools and technologies.
4. Distinguish between Proprietary and Open Source tools, development methods
5. Evaluate various Open Source projects like Linux, Apache, GIT
6. Practice Open Source principles, ethics, and models.

UNIT-I

Introduction to Open Source: Open Source, need and principles of OSS, OpenSource Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT–II

Fault Tolerant Design: Principles and Open Source Methodology- History, OpenSource Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT–III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC,LibreOffice**.**

UNIT–IV

Open Source Project: Starting and Maintaining an Open Source Project, OpenSource Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media

What Is A License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT–V

Open Source Ethics- Open Source Vs. Closed Source, Open Source Government,Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy**.**

Textbooks:

1. Kailash Vadera, Bhavyesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press, 2008.

Suggested Reading:

1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills, 2015.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media, 2004.

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3. Dan Woods, GautamGuliani, “Open Source for the Enterprise”, O’Reilly Media.
4. Bernard Golden, “Succeeding with Open Source”, Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, “Perspectives on Free and Open Source Software”, MIT press.

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20CSE107

MACHINE LEARNING LAB

Elective-I

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Pre Requisites: UG level Course in Probability and Statistics, Proficiency inprogramming basics.

Course Objectives:The objectives of this course are

1. To implement the machine learning algorithms
2. Implement the machine learning concepts in any suitable language of choice.
3. To explore Deep learning technique and various feature extraction strategies.

Course outcomes: On Successful completion of the course, students will be able to

1. Apply mathematical foundations, algorithmic principles, and computer science theory to the modeling of computer- based systems.
2. Identify and utilize modern tools that are useful for data analysis.
3. Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.
4. Implement unsupervised learning algorithms.
5. Implement and evaluate various Machine Learning approaches.
6. Design and develop solutions to real world problems using ML techniques.

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (https:// archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

Lab Experiments:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

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Textbooks:

1. Tom M. Mitchell, "Machine Learning", India Edition, McGraw Hill Education 2013.
2. Herbert Schildt& Dale Skrien, "Java Fundamentals-A Comprehensive Introduction", 2013 Edition, Tata McGraw-Hill.
3. Herbert Schildt, "The Complete Reference Java", 7 Edition, Tata McGraw-Hill 2007.
4. ReemaThareja "Python Programming", Oxford Press, 2017.
5. Mike McGrath "Python in easy steps: Makes Programming Fun", Kindle Edition, 2017.

Online Resources:

1. http://www.cs.cmu.edu/~tom/mlbook-chapter-slides.html
2. http://www.cs.cmu.edu/afs/cs.cmu.edu/user/mitchell/ftp/mlbook.html

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20CSE108

INTERNET OF THINGS LAB

Elective-I

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Pre-requisites: UG level Course in CAMP, Programming Basics.

Course Objectives: The objectives of this course are
1. Identify the vision and understand the basics of IoT.
2. Impart necessary and practical knowledge of components of Internet of Things.
3. Develop skills required to build real-time IoT based projects.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Analyze the use of communication protocols in IoT.
4. Remotely monitor data and control devices.
5. Develop real time IoT based projects.

LIST OF PRACTICALS
1. Introduction ofIoTequipment's and perform necessary software installation.
2. Write a program to interface LED/Buzzer with Arduino and to turn ON LED for 1sec after every 2 seconds.
3. Write a program to interface Digital sensor PIR with Arduino and to turn ON LED when motion detected.
4. Write a program to interface DHT22 sensor with Arduino and display temperature and humidity readings.
5. Write a program to interface motor using relay with Raspberry Pi. Turn ON motor when the temperature is high.
6. Write a program to interface LCD with Raspberry Pi and print temperature and humidity readings on it.
7. Interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth.
8. Write a program to interface flame/smoke sensor with Arduino / Raspberry Pi and give an alert message when flame/smoke is detected.
9. Install MySQL database on Raspberry Pi and perform basic SQL queries.
10. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
11. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
12. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data local/cloud server.
13. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from local/cloud server.
14. Implement any case study using Arduino/Raspberry Pi.

Textbooks:

1. ArshdeepBahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Readings:

1. Dr. SRN Reddy, RachitTirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. CunoPfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.

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Online Resources:

1. Li Da Xu, Wu He, and Shancang Li, “Internet of Things in Industries: A Survey “, IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik, JP. Vasseur, R. Alexander, “RPL: IPv6 Routing Protocol for LowPower and Lossy Networks”, IETF, Standards Track, Mar. 2012.
3. Z. Shelby , K. Hartke, C. Bormann, “The Constrained Application Protocol (CoAP)”,Internet Engineering Task Force (IETF), Standards Track, 2014.
4. L.Fenzel, “What’s The Difference Between IEEE 802.15.4 And ZigBee Wireless?”,Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, “Information theoretic self-management of Wireless Sensor Networks”, Proceedings of NCC 2013.
6. F. Luo et al., “A Distributed Gateway Selection Algorithm for UAV Networks,” in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22 -33, March 2015.

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20CSE109

INTRODUCTION TO INTELLIGENT SYSTEMS LAB
Elective-I

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Pre Requisites: Basics of python programming.

Course Objectives: The objectives of this course are
1. Design and analyze various computing algorithms and techniques using Python/Scilab.
2. Able to apply different learning algorithms to solve real time problems.
3. Recognize the underlying mathematics and logic behind various AI techniques.

Course Outcomes: On Successful completion of the course, students will be able to
1. Write programs in Python/Prolog language.
2. Recognize the underlying mathematics and logic behind various computing algorithms under AI system.
3. Apply variety of uncertain algorithms to solve problems.
4. Describe and apply various techniques for logic programming and machine learning.
5. Implement problems using game search algorithms.
6. Develop solutions for real world problems using NLP.

Lab Experiments:
1. Implement an 8-puzzle solver using Heuristic search technique.
2. Implement the Constraint Satisfaction problem using backtracking.
3. Implement a program for game search.
4. Build a bot to implement any game using easy AI library(ex.. tic-tac-toe, game of bones).
5. Implement a Bayesian network from a given data.
6. Infer the data from the Bayesian network.
7. Implement an application to classify data using Support Vector Machines.
8. Develop a NLP application to perform the following tasks.
   a. Tokenizing text data.
   b. Converting words to their base forms using stemming.
   c. Converting words to their base forms using lemmatization.
   d. Dividing text data into chunks.

9. Implement a case study on sentiment analysis.
10. Implementation of any case study using AI techniques.

Textbooks:
1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, First Edition, 2011.
2. Prateek Joshi, "Artificial Intelligence with Python:" A Comprehensive Guide to Building Intelligent Apps for Python Beginners and Developers, Packt publishing, January 2017.

Suggested Readings:
1. Prateek Joshi, Artificial Intelligence with Python – Heuristic Search [Video], PACKT, 2017.

Online Resources:
1. https://www.researchgate.net/file.PostFileLoader.html?id...assetKey
2. http://artint.info/AIPython/aipython.pdf.

20CSE110

DATA PREPARATION AND ANALYSIS LAB

Elective-III

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Course Objectives: The objectives of this course are

1. Identify data gathering and preparation techniques for industrial and scientific applications.
2. Apply exploratory data analysis techniques to develop meaningful data visualizations.
3. Analyze various statistical significance based testing mechanisms and apply them to deal with real-world problems.

Course Outcomes: On Successful completion of the course, students will be able to

1. Differentiate between numerical and categorical attributes and apply various pre-processing techniques to clean any chosen dataset.
2. Apply discretization and clustering techniques on preprocessed data.
3. Apply Association Rule mining technique to explore relationships among various attributes.
4. Apply exploratory data analysis techniques to develop meaningful data visualizations.
5. Apply various file-processing operations to deal with real-world datasets.
6. Create applications to deal with interactive datasets suitable to explore the significance of variables.

List of programs: Implement the following programs

1. Load any one dataset and perform following activities
2. List all the categorical (or nominal) attributes and the real-valued attributes separately.
3. What attributes do you think might be crucial in building the any data set?
4. Apply the cleaning process for the dataset (Replace Missing values).
5. Do you really need to input so many attributes to get good results? May be only a few would do. For example, you could try just having some combination of attributes, the class attribute (naturally)). Try out some combinations. (You had removed two attributes from the data set. Remember to reload the arff data file to get all the attributes initially before you start selecting the ones you want.)
6. Implement the discretization on any data set.
7. Demonstrate performing clustering on data sets.
8. Perform data pre-processing tasks and demonstrate performing association rule mining on data sets.
9. Load the mlb dataset and write a program to: Explore how relationships can be instantly and powerfully conveyed through the spatial arrangement of data,visual elements such as icons and lines, and most significantly, the use of animation.
   a. Loading Text Data.
   b. Files Too Large for loadStrings( )
   c. Reading Files Progressively.
   d. Reading Files Asynchronously with a Thread.
   e. Parsing Large Files As They Are Acquired.
   f. Load Milk, Tea, and Coffee dataset and perform the following activities
   g. Write a program to Acquiring a table of data from a text file.
   h. Write a program to perform parsing the contents of the file into a usable data structure.
   i. Write a program to calculate the boundaries of the data to facilitate representation.
   j. Write a program to find a suitable representation and considering alternatives.
   k. Write a program to refine the representation with consideration for placement, type, line weight, and color.

10. Design an application by providing a means of interacting with the data so that the variables can be compared against one another or against the average of the whole data set.

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Textbooks:

1. Glenn J. Myatt, "Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining", John Wiley & Sons, Inc,2007.
2. Ben Fry, "Visualizing Data: Exploring And Explaining Data With The Processing Environment", O'Reilly Media, Inc, 2007.

Suggested Readings:

1. Robert Wysocki, "Effective Project Management: " Traditional, Agile, Extreme, Sixth edition, Wiley India, rp2011.
2. Watts S. Humphrey "An Introduction to the Team Software Process", Pearson Education, 2000.
3. James R. Persse, Process Improvement essentials, O'Reilly, 2006.
4. Bob Hughes & Mike Cotterell, "Software Project Management", fourth Edition, TMH, 2006.
5. Andrew Stellman& Jennifer Greene, Applied Software Project Management, O'Reilly, 2006.

Online Resources:

1. https://www.safaribooksonline.com/library/view/visualizing- data/ 9780596514556/ch08.html.
2. https://www.scribd.com/document/54993779/Making-Sense-of-Data-a-Practical-Guide-to-Exploratory-Data-Analysis-and-Data- Mining.

20CSE111

SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING LAB

Elective-III

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Pre-Requisites :UG level Course in Computer Programming, Software Engineering, JAVA, J2EE.

Course Objectives:

1. To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic.
2. Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
3. Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

Course Outcomes: On Successful completion of the course, students will be able to

1. Develop a security model for any enterprise based application on its threats and vulnerabilities.
2. Implement methodologies and tools to design secure software enterprise application.
3. Compare different types of threats and attacks.
4. Implement the various security algorithms to be implemented for secured computing and computer networks.
5. Evaluate various methods of authentication and access control for web based applications.
6. Analyze and apply different anti-intrusion techniques.

List of Experiments:

1. Study of multi-tier software environment.
2. Study of web servers / web browser and Tools for enterprise software Development and deployment.
3. Develop a package using JDBC
4. Develop a package using servlets / JSP.
5. Study of System threat attacks - Denial of Services.
6. Implementation of S-DES algorithm for data encryption .
7. Implementation of Asymmetric Encryption Scheme – RSA.
8. Study of Symmetric Encryption Scheme – RC4.
9. Study of Techniques uses for Web Based Password Capturing.
10. Study of Anti-Intrusion Technique – Honey Pot.

Suggested Readings:

1. Paul J Perrone, Venkata S.R. Krishna R and Chayanti, "Building Java Enterprise Systems with J2EE", Techmedia , New Delhi, 2000.
2. George Reese, " Database programming, with JDBC and Java" Second Edition, O'Reiliy Publishers, New Delhi, 2000.

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20CSE112

COMPUTER VISION LAB

Elective-III

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Prerequisites: Basics of programming languages.

Course Objectives: The objectives of this course are

1 To make students acquainted with practical aspects of computing with images.
2 To improve quality of image by applying enhancement techniques.
3 To understand Feature Extraction algorithms.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify the fundamental issues and challenges of computer vision.
2. Apply image enhancement techniques.
3. Detect edges using various kernels and transformations.
4. Apply histogram processing and conversion between various colour spaces.
5. Analyze datasets using classification and clustering.
6. Evaluate computer vision system for real world problems.

Description : Use any tool like OpenCV/ Scilab/ python/R Programming etc.,

List of Programs

Familiarization of the tool used for computer vision.

1. Implement basic image operations
a. Loading and displaying an image.
b. Color formats
c. Image enhancement.
2. Implement smoothing filters on an image using
d. Gaussian filter
e. Median filter
f. Mean Filter
3. Demonstrate fourier Transformations.
4. Implement histogram calculation and equalization for the given image.
5. Implement morphological operations like dilation, erosion, opening and closing on the given image.
6. Implement edge detection on images using any two edge detection masks.
7. Detection of motion from structure .
8. Implement texture extraction of a given image.
9. Case Study :Object detection like recognizing pedestrians..
10. Case Study :Face recognition of an image using K-Means clustering.
11. Case Study :Dimensionality reduction using PCA for the givenimages.
12. Case Study :Demonstrate model based reconstruction using tensorflow.

Textbooks:

1. Gary Bradski and Adrian Kaehler, "Learning OpenCV", O'Reilly Media, Inc., 1st Edition, 2008.
2. Talita Perciano and Alejandro C Frery, "Introduction to Image Processing Using R:" Learning by Examples, Springer, 1st Edition, 2013.
3. "Computer Vision: Algorithms and Applications" by Richard Szeliski; Springer-Verlag London Limited 2011.

Suggested Readings:

1. R C Gonzalez and R E woods, "Digital Image Processing", Addison Pearson, 3rd Edition, 2013.
2. David A.Forsyth and Jean Ponce, Computer Vision-A Modern Approach, PHI, 1st Edition, 2003.

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Online Resources:

1 https://atoms.scilab.org/toolboxes/IPCV/1.1
2 https://docs.opencv.org/2.4/doc/tutorials/tutorials.html.

20CSC 103

ADVANCED DATA STRUCTURES LAB

Instruction	4 Hours per week
Duration of End Examination	3 Hours
Continuous Internal Evaluation	50
Credits	2

Prerequisites: Undergraduate course on Data Structures.

Course Objectives: The objectives of this course are
1. To use appropriate data structures and to design algorithms for a specific problem.
2. To analyze and implement dictionaries, hash algorithms skip list data structures as solutions to real-world problems.
3. To deal with text-processing algorithms and computational geometric concepts for efficient space utilization.

Course Outcomes: On Successful completion of the course, students will be able to
1. Analyze and implement various data structures like stacks, queues and priority queues using arrays.
2. Analyze and implement various data structures like stacks, queues and priority queues using linked list.
3. Implement Dictionary ADT using Linear and quadratic probing operations.
4. Construct a skip list data structure and perform various operations on it.
5. Analyze and implement various binary tree operations.
6. Analyze and implement the significance of various text processing operations for pattern matching.

List of Programs:
1. Implement StackADT using an array.
2. Implement QueueADT using an array .
3. Implement StackADT using a singly linked list.
4. Implement QueueADT using a singly linked list.
5. Implement priority queue ADT.
6. Implement all the functions of a dictionary (ADT) using Linear Probing.
7. Implement all the functions of a dictionary (ADT) using Quadratic Probing.
8. Implement skip list data structure with the following operations.
9. Construct, Search, Update.
10. Implement a binary search data structure to perform the following operations.
11. Construct a binary search tree of elements.
12. Search for a key element in the above binary search tree.
13. Delete an element from the above binary search tree.
14. Implement KMP algorithm for pattern matching.
15. Implement Boyer-Moore algorithm for pattern matching

Textbooks:
1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in JAVA", 3rdEdition, Pearson,2004.
2. M T Goodrich and Roberto Tamassia, "Algorithm Design", John Wiley, 2002.

Suggested Readings:
1. S.Sahni, "Data structures, Algorithms and Applications in Java", 2ndEdition, Universities Press,2005.
2. A.Drozdek, "Data Structures and Algorithms in java", 3rd Edition, Cengage Learning,2008.
3. J.R.Hubbard, Data Structures with Java, 2ndEdition, Schaum's Outlines, TMH, 2007.

SEMESTER - II

20CSC 104

ADVANCED ALGORITHMS

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-Requisites: UG level course in Algorithm Design and Analysis.

Course Objectives:
1. Introduce advanced methods of choosing, designing and analyzing algorithms.
2. Familiarize with basic paradigms and data structures used to solve advanced algorithmic problems.
3. Understand different classes of problems concerning their computation difficulties.

Course Outcomes: On Successful completion of the course, students will be able to
1. Define and discuss the different problems solved by using algorithmic paradigms.
2. Apply the suitable data structure for solving a problem using various strategies.
3. Differentiate the complexities of a problem solved in various approaches.
4. Evaluate various algorithmic design techniques.
5. Design appropriate mathematical notation to solve a problem using algorithmic paradigms.
6. Develop solutions for real world problem.

UNIT-I
Sorting: Review of various sorting algorithms, topological sorting
Graph: Definitions and Elementary Algorithms: Shortest path by BFS,shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

UNIT-II
Matroids: Introduction to greedy paradigm, algorithm to compute a maximumweight maximal independent set. Application to MST.
Graph Matching: Algorithm to compute maximum matching. Characterization ofmaximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT-III
Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.
Matrix Computations: Strassen's algorithm and introduction to divide andconquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT-IV
Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamicprogramming paradigm-Optimal Binary Search Tree, 0/1 Knapsack Problem, Longest Common Subsequence, Matrix Chain Multiplication .
Modulo Representation of integers/polynomials: Chinese Remainder Theorem,Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.

UNIT-V
Linear Programming: Geometry of the feasibility region and Simplex algorithm **NP-completeness:** proof of NP-hardness and NP-completeness-Clique Problem,Vertex-Cover Problem, Subset-Sum Problem.
Approximation algorithms: Introduction, Vertex-Cover Problem

Textbooks:
1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition,The MIT Press, 2009.

Suggested Readings:

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Addison-Wesley Publication, Originally published on 1974.
2. Jon Kleinberg, Eva Tardos, "Algorithm Design", Pearson Addison-Wesley Publication, 2009.

Online Resources :

1. https://nptel.ac.in/courses/106104019/

20CSC 105

SOFT COMPUTING

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Pre-Requisites :UG level course in Basic knowledge of mathematics.

Course Objectives:
1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify and describe soft computing techniques and their roles in building Intelligent Machines.
2. Comprehend appropriate learning rules for each of the neural network architectures and learn several neural network paradigms, its applications and limitations.
3. Apply fuzzy logic and reasoning to handle uncertainties and solve various engineering problems.
4. Apply genetic algorithms to combinatorial optimization problems.
5. Evaluate and compare solutions by various soft computing approaches for a given problem.
6. Recognize the underlying mathematics and logic behind various soft computing algorithms.

UNIT-I

Introduction: Evolution of Computing: Soft Computing Constituents, FromConventional AI to Computational Intelligence, Hard vs Soft computing.

UNIT-II

Artificial Neural Networks: Fundamental concepts, Evolution of neural networks,Basic models of artificial neural network, Important terminologies of ANNs. McCulloch-Pitts neuron, Linearseparability, Hebb network.Supervised Learning Neural Networks:Perceptron networks, Adaptive linear neuron(Adaline), Multiple Adaptive linear neuron (Madaline), Back propagation network

UNIT-III

Unsupervised Learning Neural Networks: Kohonenself organizing networks,Adaptive resonance theory.
Associate Memory Networks: Bidirectional associative memory network,Hopfield networks.

UNIT-IV

Fuzzy logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, MembershipFunctions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT-V

Genetic algorithms: Introduction to Genetic Algorithms (GA), Applications ofGA in Machine Learning :Simple genetic algorithm, General genetic algorithm, Classification of genetic algorithm, Machine Learning Approach to Knowledge Acquisition.

Textbooks:

1. S.N. Sivanandam& S.N. Deepa, "Principles of soft computing", Wiley publications, 2nd Edition, 2008.
2. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro :Fuzzy and Soft Computing , Prentice:Hall of India, 2003.

Suggested Readings:

1. LiMin Fu, "Neural Networks in Computer Intelligence",McGraw-Hill edition, 1994.
2. Simon Haykins, "Neural Networks a Comprehensive Foundation", PHI, second edition
3. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications , Prentice Hall, 1995.
4. MATLAB Toolkit Manual.

Online Resources :

1. www.soukalfi.edu.sk/01_NeuroFuzzyApproach.pdf
2. https://drive.google.com/file/d0B0z1VRAPGVkT2MyTXlwdE9XWXc/view?usp=sharing
3. https://github.com/rohanchikorde/Data-Sciencebooks/blob/master/ python-machine-learning-2nd.pdf
4. http://www.myreaders.info/html/soft_computing.html

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20CSC 106

ADVANCED ALGORITHM and SOFT COMPUTING LAB

Instruction	4 hrs per week
Duration of End examination	3 hrs
Continuous Internal Evaluation	50
Credits	2

Pre-Requisites :UG level course in Design and analysis of algorithm Lab usingany programming Language.

Course Objectives:

1. Familiarize with efficient utilization of programming language constructs and strategies to solve real time problems.
2. Fundamentals of Neural Networks & Feed Forward Networks, Associative Memories & ART Neural Networks.
3. Fuzzy Logic and Fuzzy Systems; Genetic Algorithms and its design.

Course Outcomes: On Successful completion of the course, students will be able to

1. Describe and analyze various advanced Algorithms.
2. Implement various algorithmic design techniques.
3. . Design and identify the suitable algorithmic paradigm to solve real world problems
4. Design and analyze various Neural Networks Architectures.
5. Implement fuzzy sets and Genetic Algorithms with its operators.
6. Apply soft computing strategies for various real time applications

List of Experiments:

1. Implementation of Sorting- heap sort, quick sort, topological sort.
2. Implementation of Minimum Spanning Trees.
3. Implementation of Maximum Sub-Array Problem, Stassen's Matrix Multiplication
4. Implementation of Shortest Path Algorithms.
5. Implementation of Longest Common Subsequence.
6. Implementation of Matrix Chain Multiplication, Simplex Algorithm.
7. Implementation of Simple Neural Network (McCulloh-Pitts model) for realizing AND Operation and OR operation using Perceptron learning algorithm.
8. Implementation of XOR problem using MADALINE network.
9. Design and implementing the back Propagation algorithm for training a non-linear network.
10. Implementation of BAM network.
11. Implementation of KSOFM network for Clustering.
12. Implement the Genetic Algorithm for TSP.

Textbooks:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press., 2009.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2nd Edition, Pearson, 2004.
3. S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing" Second Edition, Wiley Publication 2016.
4. Satish Kumar, –"Neural Networks -A classroom approach"; Second Edition, TMH, 2017.

Online Resources :

1. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms. html
2. https://www.geeksforgeeks.org/top-algorithms-and-data-structures-for-competitive-programming/
3. http://www. nptelvideos . com/java/java _ video _ Lecture Hours_tutorials.php
4. https://nptel.ac.in/courses/106104019/

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20MEC103

RESEARCH METHODOLOGY AND IPR

Instruction	2 hrs per week
Duration of End examination	2 hrs
Semester end examinations	50
CIE	20
Credits	2

Course Objectives: The objectives of this course are

1. Motivate to choose research as career.
2. Formulate the research problem, prepare the research design.
3. Identify various sources for literature review and data collection report writing.
4. Equip with good methods to analyze the collected data.
5. Know about IPR copyrights.

Course Outcomes: On Successful completion of the course, students will be able to

1. Define research problem, review and asses the quality of literature from various sources.
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs.
3. Collect the data by various methods: observation, interview, questionnaires.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square.
5. Understand apply for patent and copyrights.

UNIT-I

Research Methodology: Objectives and Motivation of Research, Types ofResearch, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem, Selection of Research Problem, Necessity of Defining the Problem.

UNIT-II

Literature Survey Report writing: Literature Survey: Importance and purposeof Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing a report.

Research Proposal Preparation: Writing a Research Proposal and ResearchReport, Writing Research Grant Proposal.

UNIT-III

Research Design: Meaning of Research Design, Need of Research Design,Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT-IV

Data Collection and Analysis: Methods of data collection, importance ofParametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test.

UNIT-V

Patents and Copyright: Patent: Macro economic impact of the patent system,Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection.

Textbooks:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004

Suggested Readings:

1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.
2. MLA Hand book for writers of Research Papers, East West PressPvt. Ltd, New Delhi, 7th Edition, 2008.
3. Lauri Rozakis, Schaum's, Quick Guide to Writing Great ResearchPapers, Tata McGraw Hills Pvt. Ltd, New Delhi, 2007.

Online Resources:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

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20EGA101

ENGLISH FOR RESEARCH PAPER WRITING
((MTech Audit Course I/II Sem- Common to all branches)

Instruction	2 hrs per week
Duration of End examination	2 hrs
Semester end examinations	50
CIE	-
Credits	-

Course Objectives: The objectives of this course are

1. To the various purposes of Research Papers and help them infer the benefits and limitations of research.
2. To developing the content, formulating a structure and illustrating the format of writing a research paper.
3. In differentiating between qualitative and quantitative research types.
4. To constructing paragraphs and developing thesis statement.
5. To producing original research papers while avoiding plagiarism.

Course Outcomes: On Successful completion of the course, students will be able to

1. Illustrate the nuances of research paper writing and draw conclusions about the benefits and limitations of research.
2. Classify different types of research papers and organize the format and citation of sources.
3. Review the literature and categorize between different types of research.
4. Draft paragraphs and write thesis statement in a scientific manner.
5. Develop an original research paper while acquiring the knowledge of how and where to publish their papers.

UNIT- I

Academic Writing: Meaning & Definition of a research paper; Purpose of a research paper – Scope, Benefits, Limitations and outcomes.

Unit -II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT -III

Research Methodology Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT- IV

Process of Writing a research paper Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading. IEEE Style.

UNIT- V

Research Paper Publication Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits.

Textbook:

1. C. R Kothari, Gaurav, Garg, Research Methodology Methods and Techniques, New Age International Publishers. 4thEdition.

Suggested Readings:

1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
2. MLA Hand book for writers of Research Papers, East West Press Pvt. Ltd, New Delhi, 7thEdition.
3. Lipson, Charles(2011), Cite Right: A Quick Guide to Citation Styles; MLA, APA, Chicago, the n)Sciences, Professions, and more (2nd Edition). Chicago [u.a] :Univ of Chicago Press.

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Online Resources:

1. NPTEL https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. NPTEL: https://nptel.ac.in/courses/121/106/121106007/
3. https://www.classcentral.com/course/swayam-introduction-to-research-5221

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20CEA101

DISASTER MITIGATION AND MANAGEMENT

(M. Tech Audit Course I/II Sem - Common to all branches)

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	50
CIE	-
Credits	-

Course Objectives: The objectives of this course are

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters.
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions.

Course Outcomes: On Successful completion of the course, students will be able to

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels.
2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management.
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same.
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

UNIT-I

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

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UNIT-IV

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological,economical, political, etc.; health, psycho-social issues; demographic aspects-gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-V

Concept of Disaster Management: Disaster management cycle – its phases;prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response-water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programs in India and the activities of National Disaster Management Authority.

Textbooks:

1. Pradeep Sahni," Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh," Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Readings:

1. Ministry of Home Affairs". Government of India, "National disaster management plan, Part I and II", Latest 2016.
2. K. K. Ghosh," Disaster Management", APH Publishing Corporation, 2006.
3. http://www. indiaenvironmentportal .org . in/files/file/ disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs, 2003.

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20EEA101

SANSKRIT FOR TECHNICAL KNOWLEDGE

(MTech. Audit Course I/II Sem - Common to all branches)

Instruction	2 hrs per week
Duration of End examination	3 hrs
Semester end examinations	50
CIE	-
Credits	-

Course Objectives:The objectives of this course are

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
2. To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects.
3. To explore the huge knowledge from ancient Indian literature.

Course Outcomes: On Successful completion of the course, students will be able to

1. Develop passion towards Sanskrit language.
2. Decipher the latent engineering principles from Sanskrit literature.
3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress.
5. Explore the avenue for research in engineering with aid of Sanskrit.

UNIT-I

Introduction to Sanskrit language: Sanskrit Alphabets-vowels-consonants-significance of Amarakosa-parts of speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive voice-Past/ Present/Future Tense-syntax-Simple Sentences (elementary treatment only)

UNIT-II

Role of Sanskrit in Basic sciences: Brahmagupthas lemmas (second degreeindeterminate equations), sum of squares of n-terms of AP- sulba_sutram or baudhayana theorem (origination of pythogorous theorem)-value of pie-Madhava's sine and cosine theory (origination of Taylor's series).The measurement system-time-mass-length-temp, Matter elasticity-optics-speed of light (origination of michealson and morley theory).

UNIT-III

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering): Building construction-soil testing-mortar-town planning-Machine definition-crucible-furnace-air blower-Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth-Pingalachandasutram (origination of digital logic system)

UNIT-IV

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languages-computer command words and the vedic command words-analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants-plants, the living-plants have senses-classification of living creatures
Chemical laboratory location and layout-equipment-distillation vessel-kosthiyanthram-

Textbooks:

1. M Krishnamachariar, History of Classical Sanskrit Literature, TTD Press, 1937.
2. M.R. Kale, A Higher Sanskrit Grammar: For the Use of School and
3. College Students, MotilalBanarsidass Publishers, ISBN-13: 978-8120801783,2015.
4. Kapail Kapoor, Language, Linguistics and Literature: The Indian
5. Perspective, ISBN-10: 8171880649, 1994.
6. Pride of India, SamskritaBharati Publisher, ISBN: 81-87276-27-4, 2007
7. Shri RamaVerma, Vedas the source of ultimate science, Nag publishers, ISBN:81-7081-618-1,2005.

20ECA101

VALUE EDUCATION

(MTech Audit Course I/II Sem - Common to all branches)

Instruction	2 hrs per week
Duration of End examination	2 hrs
Semester end examinations	50
CIE	-
Credits	-

Course Objectives : The objectives of this course are
1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals.
3. Cultivate individual and National character.

Course outcomes: On Successful completion of the course, students will be able to
1. Gain necessary Knowledge for self-development.
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life.
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept ofhumanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-management: Need and Importance of cultivationof values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III

Spiritual outlook and social values: Personality and Behavior, Scientific attitudeand Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV

Values in Holy Books: Self-management and Good health; and internal & externalCleanliness, Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Characterand Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasicgunas.

Suggested readings:

1. Chakroborty, S.K. “Values & Ethics for organizations Theory and practice”, Oxford University Press, New Delhi, 1998.
2. Jaya DayalGoyandaka, “Srimad Bhagavad Gita”, with Sanskrit Text, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.

20EGA102

INDIANCONSTITUTION & FUNDAMENTAL RIGHTS
(MTech Audit Course I/II Sem - Common to all branches)

Instruction	2 hrs per week
Duration of End examination	2 hrs
Semester end examinations	50
CIE	-
Credits	-

Course Objectives: The objectives of this course are

1. The history of Indian Constitution and its role in the Indian democracy.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement. to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes : After successful completion of the course he students will be able to :

1. Understand the making of the Indian Constitution and its features.
2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
3. Have an insight into various Organs of Governance - composition and functions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
5. Understand Electoral Process, special provisions.

UNIT-I
History of making of the Indian constitutions - History, Drafting Committee(Composition & Working).
Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-II
Contours of Constitutional Rights and Duties - Fundamental Rights, Right toEquality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III
Organs of Governance - Parliament: Composition, Qualifications, Powers andFunctions
Union executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT-IV
Local Administration - District's Administration head: Role and importance.
Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRI: Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: positions and role. Block level: Organizational Hierarchy (Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT-V
Election commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission :Role and functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Readings:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

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20ITA101

PEDAGOGY STUDIES
Audit Course-2)

Instruction	2 Hours per week
Duration of End Exam	2 Hours
Semester End Examination	50 Marks
CIE	-
Credits	-

Course Objectives: The objectives of this course are
1. To present the basic concepts of design and policies of pedagogy studies.
2. To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. To familiarize various theories of learning and their connection to teaching practice.
4. To create awareness about the practices followed by DFID, other agencies and other researchers.
5. To provide understanding of critical evidence gaps that guides the professional development.

Course Outcomes: On Successful completion of the course, students will be able to
1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

UNIT-I
Introduction and Methodology: Aims and rationale, Policy background,Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT-II
Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT-III
Evidence on the Effectiveness of Pedagogical Practices: Methodology for thein depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and pedagogic strategies.

UNIT-IV
Professional Development: alignment with classroom practices and follow upsupport - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V
Research Gaps and Future Directions: Research design – Contexts – Pedagogy -Teacher education - Curriculum and assessment – Dissemination and research impact.

Textbooks:
1. Ackers J, Hardman F, "Classroom Interaction in Kenyan Primary Schools, Compare", 31 (2): 245 – 261, 2001.
2. Agarwal M, "Curricular Reform in Schools: The importance ofevaluation", Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.

Suggested Readings:
1. Akyeampong K, "Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)", Country Report 1.London: DFID, 2003.

2. Akyeampong K, Lussier K, Pryor J, Westbrook J, “Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?, International Journal Educational Development, 33(3):272-282,2013.
3. Alexander R J, “Culture and Pedagogy: International Comparisons in
4. Primary Education”, Oxford and Boston: Blackwell, 2001.
5. Chavan M, “Read India: A mass scale, rapid, ‘learning to read’ campaign”, 2003.

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview
2. www.pratham.org/images/resources%20working%20paper%202.pdf.

20EGA103

STRESS MANAGEMENT BY YOGA

((**MTech Audit Course I/II Sem -** Common to all branches)

Instruction	2 Hours per week
Duration of End examination	2 Hours
Semester end examination	50 Marks
CIE	-
Credits	-

Course Objectives : The objectives of this course are

1. Creating awareness about different types of stress and the role of yoga in the management of stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by yoga practice.

Course Outcomes: On Successful completion of the course, students will be able to

1. To understand yoga and its benefits.
2. Enhance Physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas
5. Improve work performance and efficiency.

UNIT 1:

Meaning and definition of Yoga - Historical perspective of Yoga - Principles ofAstanga Yoga by Patanjali.

UNIT 2:

Meaning and definition of Stress - Types of stress - Eustress and Distress.Anticipatory Anxiety and Intense Anxiety and depression.Meaning of Management- Stress Management.

UNIT 3:

Concept of Stress according to Yoga - Stress assessment methods - Role ofAsana, Pranayama and Meditation in the management of stress.

UNIT 4:

Asanas- (5Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

UNIT-V

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama – Kapalabhati, Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation techniques: Om Meditation - Cyclic meditation : Instant Relaxationtechnique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Suggested Readings:

1. “Yogic Asanas for Group Training - Part-I”: Janardhan Swami Yogabhyasi Mandal, Nagpur, 2019.
2. “Rajayoga or Conquering the Internal Nature”by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata, 1998.
3. Nagendra H.R nadNagaratna R, Yoga Perspective in Stress Management, Bangalore, Swami Vivekananda Yoga Prakashan, 2014.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

Professor and Head Department

20 EGA104

PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS

(MTech. Audit Course I/II Sem - Common to all branches)

Instruction	2 Hours per week
Duration of end examination	2 Hours
Semester End Examination	50 Marks
CIE	-
Credits	-

Course Objectives: The objectives of this course are
1. To learn to achieve the highest goal happily.
2. To become a person with stable mind, pleasing personality and determination.
3. To awaken wisdom among themselves.

Course Outcomes: On Successful completion of the course, students will be able to
1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. To practice emotional self-regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

UNIT-I
Neetisatakam – Holistic development of personality - Verses 19, 20, 21, 22(Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT-II
Neetisatakam – Holistic development of personality (cont'd) - Verses 52, 53, 59(dont's) - Verses 71,73,75& 78 (do's) - Approach to day to day works and duties.

UNIT-III
Introduction to Bhagavadgeetha for Personality Development - Shrimad BhagawadGeeta: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 – Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT-IV
Statements of basic knowledge - Shrimad BhagawadGeeta: Chapter 2- Verses56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad BhagawatGeeta.

UNIT-V
Role of Bahgavadgeeta in the present scenario - Chapter 2 – Verses 17 - Chapter3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Suggested Readings:
1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata, 2016.
2. Bhartrihari'sThree Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi , 2010.

Online Courses:
1. NTPEL: http://nptel.ac.in/downloads/109104115

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20CSO 101

BUSINESS ANALYTICS
(Open Elective)

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are
1. Understanding the basic concepts of business analytics and applications.
2. Study various business analytics methods including predictive, prescriptive and prescriptive analytics.
3. Prepare the students to model business data using various data mining, decision making methods.

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify and describe complex business problems in terms of analytical models.
2. Apply appropriate analytical methods to find solutions to business problems that achieve stated objectives.
3. Interpret various metrics, measures used in business analytics
4. Illustrate various descriptive, predictive and prescriptive methods and techniques.
5. Model the business data using various business analytical methods and techniques.
6. Create viable solutions to decision making problems.

UNIT-I
Introduction to Business Analytics: Introduction to Business Analytics, needand science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

UNIT-II
Descriptive Analytics: Introduction, data types and scales, types of measurementscales, population and samples, measures of central tendency, percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization.

UNIT-III
Forecasting Techniques: Introduction, time-series data and components,forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil's coefficient

UNIT-IV
Decision Trees: CHAID, Classification and Regression tree, splitting criteria,Ensemble and method and random forest. Clustering: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, Prescriptive Analytics- Linear Programming(LP) and LP model building,

UNIT-V
Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process,cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox.

Textbooks:

1. U Dinesh Kumar, "Data Analytics", Wiley Publications, 1st Edition, 2017
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications with SAS", Associate Publishers, 2015

Suggested Readings:

1. S. Christian Albright, Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", 5th Edition, Cengage, 2015.

Online Resources::

1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview
2. https://nptel.ac.in/courses/110105089/

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20MEO 101

INDUSTRIAL SAFETY
(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are
1. Causes for industrial accidents and preventive steps to be taken.
2. Fundamental concepts of Maintenance Engineering.
3. About wear and corrosion along with preventive steps to be taken
4. The basic concepts and importance of fault tracing.
5. The steps involved in carrying out periodic and preventive maintenance of various equipments used in industry.

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify the causes for industrial accidents and suggest preventive measures.
2. Identify the basic tools and requirements of different maintenance procedures.
3. Apply different techniques to reduce and prevent Wear and corrosion in Industry.
4. Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
5. Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc.

UNIT-I
Industrial safety: Accident, causes, types, results and control, mechanical andelectrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT-II
Fundamentals of Maintenance Engineering: Definition and aim of maintenanceengineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III
Wear and Corrosion and their Prevention: Wear- types, causes, effects, wearreduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication, Definition of corrosion, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.

UNIT-IV
Fault Tracing: Fault tracing-concept and importance, decision tree concept,need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, any one machine tool, Pump, Air compressor, Internal combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V
Periodic and Preventive Maintenance: Periodic inspection-concept and need,degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

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Textbooks:

1. H. P. Garg, “Maintenance Engineering”, S. Chand and Company, 2012.
2. Audels, “Pump-hydraulic Compressors”, Mcgraw Hill Publication, 2001.

Suggested Readings:

1. Higgins & Morrow, “Maintenance Engineering Handbook”, Da Information Services, Copy Right 2002.
2. Winterkorn, Hans, “Foundation Engineering Handbook”, Chapman & Hall London, originally published 1975

20MEO102

INTRODUCTION TO OPTIMIZATION TECHNIQUES

(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are

1. Come to know the formulation of LPP models
2. Understand the Transportation and Assignment techniques
3. Come to know the procedure of Project Management along with CPM and PERT techniques
4. Understand the concepts of queuing theory and inventory models
5. Understand sequencing techniques

Course Outcomes: On Successful completion of the course, students will be able to

1. Formulate a linear programming problems (LPP).
2. Build and solve Transportation Models and Assignment Models.
3. Apply project management techniques like CPM and PERT to plan and execute project successfully.
4. Apply queing and inventory concepts in industrial applications.
5. Apply sequencing models in industries.

UNIT-I

Operations Research: Definition, scope, Models, Linear programming problems(LPP), Formulation, Graphical Method, and Simplex Method.

UNIT-II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

UNIT-III

Project Management: Definition, Procedure and Objectives of ProjectManagement, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of ES and EF times in forward path, LS & LF times in backward path, Determination of critical path, duration of the project, Free float, Independent float and Total float.

UNIT-IV

Queuing Theory and Inventory: Kendols Notation, single server models,Inventory control - deterministic inventory models - Probabilistic inventory control models.

UNIT-V

Sequencing Models: Introduction, Objectives, General assumptions, processing'n' jobs through two Machines, processing 'n' jobs through three machines.

Textbooks:

1. H.A. Taha, "Operations Research, An Introduction", PHI, 2008
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi, 2008

Suggested Readings:

1. Hitler Libermann, "Operations Research", McGraw Hill Pub. 2009
2. Pannerselvam, "Operations Research", Prentice Hall of India 2010
3. Harvey M Wagner, "Principles of Operations Research", Prentice Hall of India 2010

20CEO101

COST MANAGEMENT OF ENGINEERING PROJECTS

(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are

1. To enable the students to understand the concepts of Project management.
2. To provide knowledge on concepts of Project Planning and scheduling.
3. To create an awareness on Project Monitoring and Cost Analysis.
4. To provide adequate knowledge to the students on Recourse Management Costing-Variance Analysis.
5. To train the students with the concepts of Budgetary Control for cost management and to provide basic platform on Quantitative techniques for cost management.

Course Outcomes: On Successful completion of the course, students will be able to

1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
2. Determine the critical path of a typical project using CPM and PERT techniques.
3. Prepare a work break down plan and perform linear scheduling using various methods.
4. Solve problems of resource scheduling and leveling using network diagrams.
5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.

UNIT-I

Project Management: Introduction to project managements, stakeholders, roles,responsibilities and functional relationships.Principles of project management, objectives and project management system. Project team, organization, roles, responsibilities. Concepts of project planning, monitoring, staffing, scheduling and controlling.

UNIT-II

Project Planning and Scheduling: Introduction for project planning, definingactivities and their interdependency, time and resource estimation. Work break down structure. Linear scheduling methods-bar charts, Line of Balance (LOB), their limitations. Principles, definitions of network-based scheduling methods: CPM, PERT. Network representation, network analysis-forward and backward passes.

UNIT-III

Project Monitoring and Cost Analysis: introduction-Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making, Time cost tradeoff-Crashing project schedules, its impact on time on time, cost. Project direct and indirect costs.

UNIT-IV

Resources Management and Costing-Variance Analysis: Planning, EnterpriseResource Planning, Resource scheduling and levelling. Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis

Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis.Target costing, Life Cycle Costing. Costing of service sector.Just-in-time approach, Material Requirement.

UNIT-V

Budgetary Control: Flexible Budgets; Performance budgets; Zero-basedbudgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management: Linear Programming, PERT/CPM,Transportation Assignment problems, Simulation, Learning Curve Theory.

Suggested Readings:

1. Charles T Horngren "Cost Accounting A Managerial Emphasis", Pearson Education; 14 edition (2012),

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2. Charles T. Horngren and George Foster, “Advanced Management Accounting” Prentice-Hall; 6th Revised edition (1 February 1987)
3. Robert S Kaplan Anthony A. Atkinson, “Management & Cost Accounting” , Pearson; 2 edition (18 October 1996)
4. K. K Chitkara, “Construction Project Management: Planning, scheduling and controlling”, Tata McGraw-Hill Education. (2004).
5. Kumar NeerajJha “Construction Project Management Theory and Practice”,Pearson Education India; 2 edition (2015)

20MEO103

COMPOSITE MATERIALS
(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are
1. Composite materials and their constituents.
2. Classification of the reinforcements and evaluate the behavior of composites.
3. Fabrication methods of metal matrix composites.
4. Manufacturing of Polymer matrix composites.
5. Failure mechanisms in composite materials.

Course Outcomes: On Successful completion of the course, students will be able to
1. Classify and characterize the composite materials.
2. Describe types of reinforcements and their properties.
3. Understand different fabrication methods of metal matrix composites.
4. Understand different fabrication methods of polymer matrix composites.
5. Decide the failure of composite materials.

UNIT-I
Introduction: Definition – Classification and characteristics of Compositematerials. Advantages and application of composites.Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT-II
Reinforcements: Preparation-layup, curing, properties and applications of glassfibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT-III
Manufacturing of Metal Matrix Composites: Casting – Solid State diffusiontechnique, Cladding – Hot isostatic pressing. Properties and applications.Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT-IV
Manufacturing of Polymer Matrix Composites: Preparation of Mouldingcompounds and prepegs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT-V
Strength: Lamina Failure Criteria-strength ratio, maximum stress criteria, maximumstrain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength;

Textbooks:
1. R.W.Cahn – VCH , "Material Science and Technology", (Vol 13) Composites , West Germany, Sept. 1993.
2. WD Callister, Jr., Adapted by R. Balasubramaniam , "Materials Science and Engineering, An introduction"., John Wiley & Sons, NY, Indian edition, 2007.

Suggested Readings:
3. Ed-Lubin, "Hand Book of Composite Materials"
4. K.K.Chawla, "Composite Materials".
5. Deborah D.L. Chung, "Composite Materials Science and Applications"
6. Daniel Gay, Suong V. Hoa, and Stephen W. Tsai, "Composite Materials Design and Applications"

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20EEO 101

WASTE TO ENERGY

(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60
CIE	40
Credits	3

Course objectives: The objectives of this course are

1. To know the various forms of waste.
2. To understand the processes of Biomass Pyrolysis.
3. To learn the technique of Biomass Combustion.

Course outcomes: On Successful completion of the course, students will be able to

1. Understand the concept of conservation of waste.
2. Identify the different forms of wastage.
3. Chose the best way for conservation to produce energy from waste.
4. Explore the ways and means of combustion of biomass.
5. Develop a healthy environment for the mankind.

UNIT-I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based,Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal –Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraftgasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exoticdesigns, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V

Biogas: Properties of biogas (Calorific value and composition) - Biogas planttechnology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Text Books:

1. "Non Conventional Energy", Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. "Biogas Technology - A Practical Hand Book" - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Suggested Readings:

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

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20PYO101

HISTORY OF SCIENCE AND TECHNOLOGY

(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60
CIE	40
Credits	3

Course Objectives: The objectives of this course are

1. Gains the knowledge about origin of science in the Stone Age and its progress during Antiquity period.
2. Familiar with scientific views in the Medieval period and during the Industrial revolution.
3. Aware of modern scientific developments from 19th century onwards.

Course Outcomes: On Successful completion of the course, students will be able to

1. Demonstrate the process of beginning of science and civilization, knowledge acquisition and philosophical approach of science and its advancements in the Stone Ages and Antiquity period.
2. Illustrate the advancements in science and technology in the medieval period across Asia and Arab countries and decline and revival of science in Europe.
3. Explain the scientific approach and its advances of the Europeans and how the role of engineer during the industrial revolution and the major advancements.
4. Make use of the advancements in the field of science and technology by adopting new philosophies of 19th and first half of 20th century in finding ethical solutions to the societal problems.
5. Interpret the changes in specializations of science and the technology and build the relation between information and society from second half of 20th century onwards.

UNIT-I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization ,Major advances. Science in Antiquity (600 BC - 529 AD): Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT-II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe ,Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances. The Renaissance and the Scientific Revolution (1453 AD – 1659 AD): Renaissance, Scientific Revolution, Technology, Major advances.

UNIT-III

Scientific Method: Measurement and Communication (1660 AD – 1734): Europeandomination, The scientific method, Major advances. The Industrial Revolution (1735 AD – 1819 AD): Industrial Revolution, Rise of the engineer, Major Advances.

UNIT-IV

Science and Technology in the 19th Century (1820 AD – 1894 AD):philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances. Rise of **Modern Science and Technology (1895AD – 1945 AD):** The growth of 20thcentury science, New philosophies, Quantumreality, Energy sources, Electricity: a revolution in technology, Major advances.

UNIT-V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science,Specialization and changing categories, Technology changes society, Major advances.; **The Information Age (1973 AD – 2015 AD):**Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances

Textbooks:

1. Bryan and Alexander Hellemans, “The History of Science and Technology”, Houghton Mifflin Company, 2004.
2. JD Bernal, “Science in History”, 4 volumes, Kindle Edition.

Suggested Readings:

1. Kara Rogers, “The 100 Most Influential Scientists of All Time”, Britannica Educational Publishing, 2010
2. Alberto Hernandez, “A Visual History of Science and Technology”, The Rosen Publishing Group, 2016

20CSC 107

MINI PROJECT with SEMINAR

Instruction	4 Hours per week
Duration of End examination	-
Semester end examination	-
CIE	50 Marks
Credits	2

Pre-requisites: Basic knowledge of problem solving, Software Engineering

Course Outcomes: On Successful completion of the course, students will be able to

1. Demonstrate a sound technical knowledge of their selected project topic
2. Undertake problem identification, formulation and solution
3. Design engineering solutions to complex problems using a systems approach
4. Analyze and interpret the results using appropriate modern tools
5. Communicate with engineers and the community at large in written an oral forms.
6. Demonstrate the knowledge, skills and attitudes of a professional engineer

Guidelines:

- As part of the the curriculum in II-Semester, each student shall do a mini project. Generally student should work 3 to 4 weeks of prior reading, 12 weeks of active research, and and finally a presentation of their work for assessment
- Each student will be allotted to a faculty supervisor for monitoring the mini project work.
- Students are advised to select the mini project in such a way that they can demonstrate their competence in research techniques for the challenging issues/problems, and get an opportunity to contribute something more original.
- Mini projects shall have disciplinary/industry relevance.
- The students can select a mathematical modeling based/Experimental investigation or Numerical modeling.
- All the investigations are clearly stated and documented with the reasons/explanations.
- The mini project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, detailed discuss on results, conclusions and references.

Department Committee: Supervisor and two faculty coordinators

Guidelines for awarding marks (CIE):	**Max. Marks: 50**	
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Writing

20CSC 108

DISSERTATION PHASE-I

Instruction	20 Hours per week
Duration of End examination	-
Semester end examination	-
CIE	100 Marks
Credits	10

Pre-requisites: Research Methodologies and IPR, Basic knowledge of problem solving,

Course Outcomes: On Successful completion of the course, students will be able to

1. Inculcate the culture of self-learning on various topics
2. Review literature such as books, journal, technical documents related to problem specific domain
3. Analyze the complex real world problems
4. Formulate the solutions using the appropriate methodology
5. Design and represent solutions using the appropriate design diagrams
6. Develop research culture, communicate with engineers and the community at large in written an oral forms.

Guidelines:

- The dissertation topic shall be a complex real world problem with research potential and should involve scientific research.
- Student shall carry out literature review, gather or generate the required data and analyze data, determine the suitable solution and must preferably bring out the individual contrition.
- Seminar shall be based on the area in which the student has undertaken the dissertation work.
- The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature reviewed.
- The preliminary results (if available) of the problem along with the design may also be discussed in the report
- The work carried out by the student shall be presented in front of the Committee consisting of Head, Chairman-BoS, Supervisor and Project Coordinator
- Students shall be in regular contact with their supervisor and the topic of dissertation must be mutually decided by the supervisor and the student.

CIE Assessment Guidelines Max Marks: 100		
Evaluation by	**Max. Marks**	**Evaluation Criteria**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the topic
	10	PPT Preparation(s)
	10	presentation(s)
	10	Question and Answers
	10	Report preparation

Note : Department committee has to assess the Every two weeks.

20CSC 109

DISSERTATION PHASE-II

Instruction	32 Hours per week
Duration of SEE	3
SEE	100 Marks
CIE	100 Marks
Credits	16

Pre-requisites: Research Methodologies and IPR, Basic knowledge of problem solving,Technical Writing

Course Outcomes: On Successful completion of the course, students will be able to

1. Use different experimentation techniques and technologies
2. Develop experimental set up/ Environment test rig
3. Conduct experiments by using the benchmark data sets
4. Analyze and interpret the results by using appropriate modern tools
5. Communicate effectively with technical reports and oral presentation
6. Make research contributions by publishing their work to the research community

Guidelines:

- It is a continuation of Project work started in semester III-Semester.
- Students have to submit the report in a prescribed format and also present a seminars
- The dissertation work shall be presented in a standard format as provided by the department.
- Students have to prepare a detailed project report report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology experimental set up or numerical details as the case may be) of solution and results and discussions.
- The report must also bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner (HoD, and BoS Chairperson), supervisor/Co-Supervisor.
- Students should be in regular contact with their supervisor/Co-Supervisor.

CIE Assessment Guidelines		**Max Marks: 100**
Evaluation by	**Max. Marks**	**Evaluation Criteria**
Supervisor	05	Review-1
	10	Review-2
	10	Review-3
	15	Final presentation with the draft copy of the report in a standard format
	10	Submission of the report
Department Committee	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of work which may lead to publication
	10	Analytical Programming / Experimental Skills Preparation
	10	Report preparation in a standard format

SEE Assessment Guidelines		**Max Marks: 100**
Evaluation by	**Max. Marks**	**Evaluation Criteria**
Supervisor	20	Power Point Presentation
	40	Quality of dissertation report and Evaluation
Department Committee	20	Quality of the Dissertation: • Innovations • Applications • Live Research work • Scope for future study • Application to Society • Regularity and Punctuality
	20	Viva-Voce

Note: Department Committee shall assess the progress of the student for every TWO weeks.

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20MT C01

LINEAR ALGEBRA & CALCULUS
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block chain Technology))

Instruction	3 L Hours per week
Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	3

Course Objectives:

1. To explain the solutions of system of linear equations by Matrix Methods.
2. To discuss the convergence and divergence of the Series.
3. To explain the Partial Derivatives and the extreme values of functions of two variables
4. To discuss Physical interpretations on Scalars and vector functions
5. To discuss vector line, surface and volume integrals.

Course Outcomes:
Upon completing this course, students will be able to:

1. Apply the Matrix Methods to solve the system of linear equations
2. Test the convergence and divergence of the infinite Series.
3. Determine the extreme values of functions of two variables.
4. Apply the vector differential operator to scalar and vector functions
5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.

UNIT-I
Matrices: Rank of a matrix, Echelon form, consistency of linear System of equations, Linear dependence of vectors, Eigen values, Eigenvectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-II
Infinite Series: Definition of Convergence of sequence and series. Series of positive terms –Necessary condition for convergence, Comparison tests, limit form comparison test, D'Alembert's Ratio test, Raabe's test, Cauchy's root test, alternating series, Leibnitz's rule, absolutely and conditionally convergence.

UNIT-III
Partial Differentiation and Its Applications : Functions of two or more variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions, Jacobians, Taylor's expansion of functions of two variables, Maxima and minima of functions of two variables.

UNIT-IV
Vector Differential Calculus: Scalar and vector point functions, vector operator Del, Gradient, Directional derivative, Divergence, Curl, Del applied twice to point functions, Del applied to product of point functions (vector identities). Applications: Irrotational fields and Solenoidal fields.

UNIT-V
Vector Integral Calculus: Line integral, Surface integral and Volume integral. Green's theorem in the plane, verifications of Stroke's theorem (without proof) and Gauss's divergence theorem (without proof).

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw- Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

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20 EG C01

ENGLISH

(Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	60Marks
CIE	40Marks
Credits	2

Course Objectives: This course will introduce the students:

1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

Course Outcomes: After successful completion of the course the students will be able to:

1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques

UNIT-I Understanding Communication in English:

Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.

Vocabulary &Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT-II Developing Writing Skills I:

Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.

Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT-III Developing Writing Skills II:

Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response

Vocabulary and Grammar: Subject-verb agreement.

Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

UNIT-IV Developing Writing Skills III:

Report writing – Importance, structure, elements of style of formal reports ; Writing a formal report.

Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

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UNIT-V Developing Reading Skills:
The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar: Words often confused; Use of standard abbreviations.

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan,2017.
2. Swan Michael, Practical English Usage.OUP.1995.

Suggested Readings:

1. Wood F.T, Remedial English Grammar,Macmillan,2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, Communication Skills. Oxford University Press,2011.

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Code: 20PY C01

OPTICS AND SEMICONDUCTOR PHYSICS

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block chain Technology))

Instruction	3L/week
Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	3

Course Objectives: The objectives of the course is to make the student

1. Understand the fundamentals of wave nature of light
2. Acquire knowledge of lasers, holography and fiber optics
3. Familiarize with quantum mechanics
4. Learn the fundamental concepts of solids

Course Outcomes: At the end of the course, the student will be able to

1. Demonstrate the physical properties of light.
2. Explain characteristic properties of lasers and fiber optics
3. Find the applications of quantum mechanics
4. Classify the solids depending upon electrical conductivity
5. Identify different types of semiconductors

UNIT-I

Wave Optics: Huygens' principle –Superposition of waves –Interference of light by wave front splitting and amplitude splitting–Fresnel's biprism – Interference in thin films in reflected light– Newton's rings–Fraunhofer diffraction from a single slit –Double slit diffraction – Rayleigh criterion for limit of resolution– Concept of N-slits–Diffraction grating and its resolving power.

UNIT-II

Lasers & Holography: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion –Different types of lasers: solid-state lasers: Ruby &Nd:YAG; gas lasers: He-Ne & CO_2; semiconductor laser –Applications of lasers in engineering and medicine. Holography: Principle – Recording and reconstruction–Applications.

Fiber Optics: Introduction –Construction –Principle –Propagation of light through an optical fiber – Numerical aperture and acceptance angle –Step-index and graded-index fibers –Pulse dispersion –Fiber losses–Fiber optic communication system –Applications.

UNIT-III

Principles of Quantum Mechanics: Introduction –Wave nature of particles – de-Broglie hypothesis – Physical significance of ψ –Time-dependent and time-independent Schrodinger equations – Born interpretation – Probability current –Wave packets –Uncertainty principle –Particle in infinite square well potential –Scattering from potential step – Potential barrier and tunneling.

UNIT-IV

Band Theory of Solids: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level –Density of states – Bloch's theorem for particles in a periodic potential – Kronig-Penney model – Classification of solids: metals, semiconductors and insulators.

UNIT-V

Semiconductors: Intrinsic and extrinsic semiconductors –Charge carrier concentration in intrinsic semiconductors –Dependence of Fermi level on carrier concentration and temperature in extrinsic semiconductors (qualitative) –Carrier generation and recombination –Carrier transport: diffusion and drift – P-N junction – Thermistor – Hall effect – LED –Solar cell.

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TEXT BOOKS:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

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20CS C01

PROGRAMMING FOR PROBLEM SOLVING
(Common to all Programs)

Instruction	3 Periods per week
Duration of End Examination	3Hours
Semester End Examination	60 Marks
Sessional	40 Marks
Credits	3

Course Objectives: The objectives of this course are
1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
4. Develop in tuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify and understand the computing environments for scientific and mathematical problems.
2. Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
3. Choose data types and control structures to solve mathematical and scientific problem.
4. Decompose a problem into modules and use functions to implement the modules.
5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
6. Develop applications using file I/O.

UNIT -I
Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.
Introduction to programming: Programming languages and generations, categorization of high-level languages.
Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence, and associativity.

UNIT – II
Introduction to decision control statements: Selective, looping, and nested statements.
Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes, Case study using functions and control statements.

UNIT – III
Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting (Selection and Bubble) algorithms, 2-D arrays, matrix operations.
Strings: Introduction, strings representation, string operations with examples. Case study using arrays.

UNIT – IV
Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, dynamic memory allocation, advantages, and drawbacks of pointers.
Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions, and enumerated data types.

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UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.

Preprocessor Directives: Types of preprocessor directives, examples.

Text Books:

1. M.T. Somashekar “Problem Solving with C”, 2nd Edition, Prentice Hall India Learning Private Limited 2018
2. AK Sharma, “Computer Fundamentals and Programming”, 2nd Edition, University Press, 2018
3. Pradeep Deyand Manas Ghosh, “Programming in C”, Oxford Press,2nd Edition,2017

Suggested Reading:

1. Byron Gottfried, Schaum’s Outline of Programming with C”, Mc Graw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Reema Tharaja “Introduction to C Programming”, Second Edition, OXFORD Press, 2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm.
2. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

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20MT C02

LINEAR ALGEBRA & CALCULUS (LAB)

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block chain Technology))

Instruction	2P Hours per week
Duration of SEE	3Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:
1. To explain basic operations of matrix algebra.
2. To discuss the behavior of the infinite Series.
3. To discuss the maxima and minima of the functions of two variables
4. To discuss Physical interpretations on Scalars and vector functions.
5. To explain vector line, surface and volume integrals.

Course Outcomes:

Upon completing this course, students will be able to:
1. Apply the Matrix operations in executing various programmes.
2. Test the convergence and divergence of the infinite Series.
3. Explore the extreme values of functions of two variables.
4. Determine the gradient, divergent and curl of scalar and vector point functions.
5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems

LIST OF EXPERIMENTS:

1. Addition and multiplication of higher order matrices.
2. Determinant and Inverse of the matrices
3. Eigen values and Eigenvectors of Matrix.
4. Nature of quadratic form of Matrix.
5. Solution of system of linear equations.
6. Data plotting (2D,3D)
7. Test the convergence of infinite series
8. Examine the extreme values of given function
9. Examine the rotational, irrotational and divergence of the flows
10. Verify inter connection between vector theorems (Green's, Gauss and Stoke's Theorems)

Text Books / Suggested Reading / Online Resources:

1. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
2. https://www.scilab.org/tutorials\
3. https://nptel.ac.in/courses/106102064/
4. https://www.udemy.com/algorithms-and-data-structures-in-python/

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20EG C02

ENGLISH LAB

(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	1

Course Objectives: This course will introduce the students:

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behavior while developing their ability to discuss in groups and making oral presentations.

Course Outcomes: After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams ,and discuss and participate in Group discussions.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material
6. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary –** weaving an imaginative story around a given picture.
9. **Information Gap Activity –** Writing a brief report on a newspaper headline by building on the hints given
10. **Poster presentation** – Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt. Ltd., 2011
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016

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20PY C03

OPTICS AND SEMICONDUCTOR PHYSICS LAB

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	4Periods/week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2

Course Objectives: The objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments
2. Understand the behaviour of the light experimentally
3. Analyze the conduction behaviour of semiconductor materials and optoelectronic devices

Course Outcomes: At the end of the course, the student will be able to

1. Interpret the errors in the results of an experiment.
2. Demonstrate physical properties of light experimentally
3. Make use of lasers and optical fibers for engineering applications
4. Explain the V-I characteristics of some optoelectronic and semiconductor devices
5. Find the applications thermistor

Experiments

1.	Error Analysis	:	Estimation of errors in the determination of time period of a torsional pendulum
2.	Fresnel's Biprism	:	Determination of wavelength of given monochromatic source
3.	Newton's Rings	:	Determination of wavelength of given monochromatic source
4.	Single Slit Diffraction	:	Determination of wavelength of given monochromatic source
5.	Diffraction Grating	:	Determination of wavelengths of two yellow lines of light of mercury lamp
6.	Laser	:	Determination of wavelength of given semiconductor laser
7.	Holography	:	Recording and reconstruction of a hologram
8.	Optical Fiber	:	Determination of numerical aperture and power losses of given optical fiber
9.	Energy Gap	:	Determination of energy gap of given semiconductor
10.	P-N Junction Diode	:	Study of V-I characteristics and calculation of resistance of given diode in forward bias and reverse bias
11.	Thermistor	:	Determination of temperature coefficient of resistance of given thermistor
12.	Hall Effect	:	Determination of Hall coefficient, carrier concentration and mobility of charge carriers of given semiconductor specimen
13.	LED	:	Study of I-V characteristics of given LED
14.	Solar Cell	:	Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance
15.	Planck's Constant	:	Determination of Planck's constant using photo cell

NOTE: A minimum of TWELVE experiments should be completed.

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20CS C02

PROGRAMMING FOR PROBLEM SOLVING LAB
(Common to All Programs)

Instruction	4 Periods per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2

Course Objectives: The objectives of this course are

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and setup program development environment.
2. Design and test programs to solve mathematical and scientific problems.
3. Identify and rectify the syntax errors and debug program for semantic errors
4. Implement modular programs using functions.
5. Represent data in arrays, pointers, structures and manipulate them through a program.
6. Create, read, and write to and from simple text files.

Lab Experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

Text Books:

1. Pradeep Dey and Manas Ghosh, “Programming in C”, Oxford Press, 2nd Edition, 2017.
2. Reema Tharaja “Introduction to C Programming”, Second Edition, OXFORD Press, 2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

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20ME C01

CAD AND DRAFTING

Instruction	1 T + 3 D Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2.5

Course Objectives:
1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

Outcomes: At the end of the course, the Students are able to
1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

List of Exercises:
1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice versa.

Text Books:

1. N.D.Bhatt, "Elementary Engineering Drawing", Charotar Publishers,2012.
2. K.Venugopal, "Engineering Drawing and Graphics + AutoCAD", New Age International Pvt.Ltd,2011.
3. Basanth Agrawal and C M Agrawal, "Engineering Drawing", 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., "Engineering Drawing", 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011.

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20MBC02

COMMUNITY ENGAGEMENT

Instruction	3 Hours per week (30 hours field work & 2 hours per week)
SEE	Nil
CIE	50 Marks
Credits	1.5 Credits

Course Objectives: The main Objectives of this Course are to:

1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

Course Outcomes: After the completion of this Course, Student will be able to:

1. Gain an understanding of Rural life, Culture and Social realities.
2. Develop a sense of empathy and bonds of mutuality with Local Communities.
3. Appreciate significant contributions of Local communities to Indian Society and Economy.
4. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
5. Utilise the opportunities provided by Rural Development Programmes.

Module I Appreciation of Rural Society

Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

Module II Understanding Rural Economy and Livelihood

Agriculture, Farming, Landownership, Water management, Animal Husbandry, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III Rural Institutions

Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees, Local Civil Society, Local Administration.

Module IV Rural Development Programmes

History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

Text Books:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

Journals:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).

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20MT C03

DIFFERENTIAL EQUATIONS &TRANSFORM THEORY

(CSE,IT, CSE (AI&ML), AI&DS, CSE (IOT &Cyber Security including Block Chain Technology))

Instruction	3 L per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss the properties of Legendre's Polynomials and Bessel's functions
4. To explain the Z-Transform and InverseZ-Transforms.
5. To discuss Fourier transform for solving engineering problems.

Course Outcomes:

Upon completing this course, students will be able to:

1. Calculate the solutions of first order linear differential equations.
2. Calculate the solutions of higher order linear differential equations.
3. Examine the series solutions for higher order differential equations.
4. Evaluate the Improper integrals by Fourier Transform.
5. Solve the difference equations byZ-transforms.

UNIT - I

Differential Equations of First Order: Exact Differential Equations, Equations Reducible To Exact Equations, Linear Equations, Bernoulli's Equations, Riccati's and Clairaut's Equations, Orthogonal trajectories.

UNIT-II

Higher Order Linear Differential Equations: Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Cauchy's homogeneous linear equation. applications: LR and LCRcircuits.

UNIT-III

Series Solutions of Differential Equations: Ordinary point, singular point and regular singular point, Series solution when **x=a** is an ordinary point of the equation. Legendre's equation, Legendre's Polynomial of first kind (without proof), Rodrigue's formula, orthogonality of Legendre polynomials. Bessel's equation, Bessel's function of the first kind of order n (without proof), recurrence formulae for **Jn(x)** and related problems (i.eJ0(x), J1(x), J1/2(x), J-1/2(x), J3/2 (x), J-3/2(x)).

UNIT-IV

Fourier Transforms: Fourier integral theorem (statement), Complex form of Fourier integrals. Fourier transforms, Inverse Fourier Transforms, Fourier Sine and Cosine transforms, Inverse Fourier Sine and Cosine Transforms. Properties of Fourier transforms: Linear property, change of scale property, shifting property and Modulation theorem.

UNIT-V

Z-Transforms: Definition, some standard Z-transforms, linearity property, damping rule, shifting Un to the right, shifting Un to the left, multiplication by 'n', initial and final value theorems. Inverse Z-Transform: evaluation of Inverse Z-transform by Convolution theorem, partial fractions method. Z- Transform application to difference equations.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. R.K.Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.

Suggested Reading:

1. N.P.Bali and Manish Goyal, Atext book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11^{th} Reprint, 2010.
3. A.R.Vasishtha, and R.K.Guptha Integral transforms, Krishna Prakashan Media, Reprint, 2016

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20CY C01

CHEMISTRY

(Common to all branches)

Instruction:	3Hours per Week
Duration of SEE:	3 Hours
SEE	60 Marks
CIE:	40 Marks
Credits:	3

Course Objectives

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

Course Outcomes

At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

UNIT-I Atomic and molecular structure and Chemical Kinetics:

Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2 , He_2^+ ,N_2 , O_2 , O_2^- , CO, NO). Pi- molecular orbitals of benzene and its aromaticity.

Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction-Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, – Reference electrodes (NHE, SCE)-electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations. Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.
Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages.
Construction, working & applications of methanol-oxygen fuel cell.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism - Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid) & Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.

Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)

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Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)
Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides)
Cyclization (Diels - Alder reaction)

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process),ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V Engineering Materials and Drugs:
Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber). Conducting polymers- Definition, classification and applications.
Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography.
Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation-Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle).
Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition (2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla, Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Readings:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

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20ITC01

DATA STRUCTURES AND ALGORITHMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To introduce representation, specification, and applications of various linear and nonlinear data structures.
2. To familiarize with asymptotic analysis of iterative and recursive functions.
3. To acquaint with various pattern matching algorithms.
4. To present different sorting algorithms.
5. To explain hashing and collision handling.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Analyse time complexity of both iterative and recursive functions.
2. Understand various sorting algorithms and their performance
3. Build optimal solutions using linear and nonlinear data structures.
4. Apply pattern matching.
5. Understand hash functions and collision handling

UNIT-I

Introduction: Data Structures, Abstract Data Types, Algorithm, Analysis of Algorithms, Running Time Analysis, Commonly Used Rates of Growth, Big O Notation, Omega Notation, Theta Notation, Guidelines for Asymptotic Analysis

Recursion: Introduction, Recursion and Memory, Recursion versus Iteration, Example algorithms of Recursion

Sorting: Introduction, Classification of Sorting Algorithms, Selection Sort, Insertion Sort, Merge Sort, Heap Sort, Quick Sort, Radix sort, Comparison of Sorting Algorithms

Searching: Introduction, Types of Searching, Unordered Linear Search, Sorted/Ordered Linear Search, Binary Search

UNIT-II

Linked Lists: Linked List ADT, Comparison of Linked Lists with Arrays and Dynamic Arrays, Singly Linked Lists, Doubly Linked Lists, Circular Linked Lists

Stacks: Stack ADT, Applications, Implementation, Comparison of Implementations, Stacks: Problems & Solutions

UNIT-III

Queues: Queue ADT, Exceptions, Applications, Implementations, Queues: Problems & Solutions

Trees: Introduction, Glossary, Binary Trees, Types of Binary Trees, Properties of Binary Trees, Binary Tree Traversals, Binary Search Trees (BSTs), Balanced Binary Search Trees, AVL Trees: Properties, rotations, insertion

UNIT-IV

Priority Queues and Heaps: Priority Queue *AD*T, Priority Queue Applications, Priority Queue Implementations, Heaps and Binary Heaps, Binary Heaps, Heap Sort

String Algorithms: Introduction, String Matching Algorithm, Brute Force Method, String Matching with Finite Automata, KMP, Tries, Ternary Search Trees, Suffix Trees

UNIT-V

Graph: Introduction, Applications of Graphs, Graph Representation, Graph Traversals, Minimal Spanning Tree

Hashing: Hash Table ADT, Components of Hashing, Hash Table, Hash Function, Load Factor, Collisions, Collision Resolution Techniques, Separate Chaining, Open Addressing, Comparison of Collision Resolution Techniques, Hashing Techniques, Limitations of Hash Tables.

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Text Book:

1. Narasimha Karumanchi, "Data Structures And Algorithmic Thinking With Python", Career Monk Publications, 2016

Suggested Reading:

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structure and Algorithms in Python”, Wiley, 2013.
2. Kenneth A. Lambert, " Fundamentals of Python: Data Structures", Cengage Learning, 2018.
3. Narasimha Karumanchi, “Data Structures and Algorithms for GATE”, Career Monk Publications, 2011.
4. D. Samantha, “Classic Data Structures”, Prentice Hall India, 2nd Edition, 2013.

Web Resources:

1. https://visualgo.net/en
2. https://www.coursera.org/specializations/data-structures-algorithms
3. https://nptel.ac.in/courses/106/106/106106182/
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms
5. https://www.edx.org/course/algorithms-and-data-structures

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20ITC02

OBJECT ORIENTED PROGRAMMING USING PYTHON

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Course Objectives:

1. To describe the principles of Object-Oriented Programming.
2. To familiarize with basics of python programming
3. To explain the usage of OOP concepts to provide solutions
4. To introduce exception handling, and file operations in python
5. To acquaint with tkinter module to develop GUI applications.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the concepts Object-Oriented Programming
2. Make use of Python programming constructs to implement solutions to problems
3. Model the problem using OOP strategies and handle exceptions
4. Make use of files and perform file handling operations.
5. Develop GUI's

UNIT - I

Introduction to Object Oriented Programming (OOP): Computer Programming and Programming Languages, Features of Object Oriented Programming, Merits and Demerits of Object, Applications of Object Oriented Programming, Differences between Popular Programming Languages

Basics of Python Programming: Features, History, Future, Writing and Executing First Python Program, Literal Constants, Variables and Identifiers, Data Types, Input Operation, Comments, Reserved Words, Indentation, Operators and Expressions, Expressions in Python, Operations on Strings, Other Data Types, Type Conversion

UNIT - II

Decision Control Statements: Introduction to Decision Control Statements, Selection/Conditional Branching Statements, Basic Loop Structures/ Iterative Statements, Nested Loops, The break Statement, The continue Statement, The pass Statement, The else Statement used with Loops

Functions and Modules: Introduction, Function Definition, Function Call, Variable Scope and Lifetime, The return statement, More on Defining Functions, Lambda Functions or Anonymous Functions, Documentation Strings, Good Programming Practices, Recursive Functions, Greatest Common Divisor, Finding Exponents, The Fibonacci Series, Recursion vs Iteration, Modules, Packages in Python, Standard Library modules, Globals(), Locals(), and Reload(), Function Redefinition

UNIT – III

Classes and Objects: Introduction, Classes and Objects, init method, Class variables, and Object variables, Public and Private Data members, calling methods from other methods, built-in class attributes, garbage collection, class methods, static methods.

File Handling: Introduction, File Path, Types of Files, Opening and Closing Files, Reading and Writing Files

UNIT-IV

Inheritance: Introduction, Inheriting classes, Types of Inheritance, Composition or Containership or complex objects, Abstract classes and interfaces.

Operator Overloading: Introduction, Implementation of Operator Overloading, Reverse Adding, Overriding __getitem__() and __ setitem__() Methods, Overriding the in Operator, Overloading Miscellaneous Functions, Overriding the __call__() method

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UNIT-V

Error and Exception Handling: Introduction to errors and exceptions, Handling Exceptions, Multiple Except Blocks, Multiple Exceptions in a Single Block, Except Block Without Exception, The else Clause, Raising Exceptions, Instantiating Exceptions, Handling Exceptions in Invoked Functions, Built-in and User-defined Exceptions, The finally Block, Pre-defined Clean–up Action, Re-raising Exception, Assertions in Python

GUI Programming with tkinter package

Text Book:

1. Reema Thareja "Python Programming: Using Problem Solving Approach" , Oxford University Press, 2019

Suggested Reading:

1. Tony Gaddis, "Starting Out With Python", 3rd edition, Pearson, 2015.
2. Kenneth A. Lambert, " Fundamentals of Python: Data Structures", Cengage Learning, 2018.
3. Alan D. Moore, "Python GUI programming with Tkinter", 2018

Web Resources:

1. https://www.python.org/
2. https://nptel.ac.in/courses/106/106/106106182/
3. https://www.coursera.org/learn/python
4. https://learnpythonthehardway.org/book/

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20MT C04

DIFFERENTIAL EQUATIONS &TRANSFORM THEORY LAB
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IOT & Cyber Security including Block Chain Technology)

Instruction	2P Hours per week
Duration of SEE	3Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss the properties of Legendre's Polynomials and Bessel's functions
4. To explain the Z-Transform and InverseZ-Transforms.
5. To discuss Fourier transform for solving engineering problems.

Course Outcomes:

Upon completing this course, students will be able to:

1. Explore all the possible solutions of first order differential equation.
2. Analyse the solutions of higher order linear differential equations.
3. Examine the series solutions for higher order differential equations.
4. Evaluate the Improper integrals by Fourier Transform.
5. Apply the Z-transform to solve the difference equations.

List of Programmes:

1. Solution of first order liner differential equations.
2. Solution of first order non liner differential equations
3. Geometrical view of Particular integral of higher order differential equations.
4. Simulations of Legendre's differential equations.
5. Geometrical view of Rodrigue's theorem.
6. Simulations of Bessel's first kind solution.
7. Solutions of Bessel's first kind
   (i.e. J0(x), J1(x), J1/2(x), J3/2 (x), J-1/2(x), J-3/2(x))
8. Waveform generation continuous signals
9. Computation of Fourier Transformations
10. Discrete Cosine Transforms
11. Digitization of continuous functions.

Text Books / Suggested Reading / Online Resources:

1. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
2. https://www.scilab.org/tutorials\
3. https://nptel.ac.in/courses/106102064/
4. https://www.udemy.com/algorithms-and-data-structures-in-python/

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20CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	4 Hours per Week
Duration of SEE	3 Hours
SEE:	50 Marks
CIE	50 Marks
Credits:	2

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theorical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes

At the end of the course student will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

Chemistry Lab

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2}& Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

Text Books:

1. J. Mendham and Thomas , "Vogel's text book of quantitative chemical analysis", Pearson education Pvt. Ltd. New Delhi , 6th ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg & A.Gulati,; R. Chand & Co. : New Delhi (2011).

Suggested Readings:

1. Dr.Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

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20IT C03 **DATA STRUCTURES AND ALGORITHMS LAB**

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To introduce predefined data structures of Python
2. To introduce Linked Lists and operations
3. To present Stacks, Queues and their applications
4. To familiarise with Sorting Algorithms and Hashing
5. To gain knowledge of Trees, Graphs, Tries and related algorithms

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Make use of predefined data structures of python to process data.
2. Evaluate the performance of Sorting algorithms
3. Demonstrate Arrays, Linked lists, Stacks, Queues, Binary Search Trees, Graphs
4. Make use of Hashing and perform data storing and retrieval
5. Build optimal solutions using linear and nonlinear data structures to real world problems.

List of Programs

1. Demonstrate the usage of predefined data structures of Python: List, Tuple, String, Set, Dictionary.
2. Implementation of recursive and iterative functions.
3. Implement the following sorting algorithms: Selection Sort, Insertion Sort, Merge Sort, Heap Sort, Quick Sort, Radix Sort.
4. Define Single Linked List ADT and perform all standard operations.
5. Define Doubly Linked List ADT and perform all standard operations.
6. Define Stack and Queue ADTs and implement standard operations.
7. Applications of Stacks and Queues.
8. Implementation of Binary Search Tree.
9. Implementation of Graph traversal techniques.
10. Implementation of Hashing.
11. Implementation of Tries.

Text Book:

1. Narasimha Karumanchi, "Data Structures And Algorithmic Thinking With Python", Career Monk Publications, 2016

Suggested Reading:

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structure and Algorithms in Python”, Wiley, 2013.
2. Kenneth A. Lambert, " Fundamentals of Python: Data Structures", Cengage Learning, 2018.
3. Narasimha Karumanchi, “Data Structures and Algorithms for GATE”, Career Monk Publications, 2011.
4. D. Samantha, “Classic Data Structures”, Prentice Hall India, 2ndEdition, 2013.

Web Resources:

1. https://www.geeksforgeeks.org/data-structures/
2. https://www.coursera.org/specializations/data-structures-algorithms
3. https://nptel.ac.in/courses/106/106/106106182/
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms

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20IT C04

OBJECT ORIENTED PROGRAMMING USING PYTHON LAB

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:
1. To familiarize with basics of python programming
2. To explain the usage of OOP concepts to provide solutions
3. To acquaint with Functions and Modules
4. To explain exception handling, file operations in python
5. To introduce library modules to develop GUI applications.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Make use of Python programming constructs to implement solutions to problems
2. Model the problem using OOP strategies and handle exceptions
3. Make use of files and perform file handling operations.
4. Develop GUI's
5. Build solutions to real world problems

List of Programs

1. Demonstrate the use of basic data types and operators.
2. Demonstrate the use of control structures.
3. Implementations of Functions, Lambda functions and parameter passing.
4. Demonstrate the usage of predefined Modules.
5. Implementation of classes with attributes and methods.
6. Demonstration of inheritance.
7. Implementation of Overloading.
8. Implementation of file operations
9. Implementation of Exception Handling
10. Building GUIs.

Text Book:
1. Reema Thareja, "Python Programming: Using Problem Solving Approach" , Oxford University Press, 2019

Suggested Reading:
1. Tony Gaddis, "Starting Out With Python", 3rd edition, Pearson, 2015.
2. Kenneth A. Lambert, " Fundamentals of Python: Data Structures", Cengage Learning, 2018.
3. Alan D. Moore, "Python GUI programming with Tkinter", 2018

Web Resources:
1. https://www.python.org/
2. https://nptel.ac.in/courses/106/106/106106182/
3. https://www.coursera.org/learn/python
4. https://learnpythonthehardway.org/book/

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20ME C02

WORKSHOP / MANUFACTURING PRACTICE

Instruction	5 P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives:
1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive &team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes: At the end of the course, the students are able to
1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
3. Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
4. Perform various operations in welding, machining and casting processes.
5. Conceptualize and produce simple device/mechanism of their choice.

List of Exercises

CYCLE 1

Exercises in Carpentry
1. To plane the given wooden piece to required size
2. To make a lap joint on the given wooden piece according to the given dimensions.
3. To make a dove tail-joint on the given wooden piece according to the given dimensions.

Exercises in Tin Smithy
1. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
2. To make a scoop.
3. To make a pamphlet box.

Exercises in Fitting
1. To make a perfect rectangular MS flat and to do parallel cuts using Hacksaw
2. To make male and female fitting using MSflats-Assembly1
3. To make male and female fitting using MSflats-Assembly2

Exercises in House Wiring
1. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch, and wiring of one buzzer controlled by a bellpush
2. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket
3. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- ways witches.

CYCLE 2

Exercises in Casting

1. Study of Sand casting process and its applications**.**
2. Green sand moulding practice for a single piece pattern
3. Green sand moulding practice for a split pattern with a horizontal core

Exercises in Welding

1. Study of gas welding equipment and process. Identification of flames, making of Butt joint with gas welding.
2. Study of Arc welding process, making Butt joint with DCSP, DCRP
3. Study of Arc welding process, making Lap joint with A.C

Exercises in Machine shop

1. Study of Machine Tools like Lathe, Drilling, Milling and Shaper.
2. Facing, Plain turning and Step turning operations on Lathe machine.
3. Knurling and Taper turning on Lathe machine

Open ended Exercise:

1. Student should produce a component /mechanism by applying the knowledge of any one trade or combination of trades.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I, 2008 and Vol. II, 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology",4th edition, Pearson Education India Edition, 2002.
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I", Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

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20ME C03

ENGINEERING EXPLORATION
(PRACTICAL)

Instruction	4 Hours per week
Duration of SEE	Nil
SEE	Nil
CIE	50Marks
Credits	1.5

Prerequisites: Nil

Course Outcomes: At the end of the course, the students are able to

1. Understand the role of an engineer as a problem solver.
2. Identify multi-disciplinary approaches in solving an engineering problem.
3. Build simple systems using engineering design process.
4. Analyze engineering solutions from ethical and sustainability perspectives.
5. Use basics of engineering project management skills in doing projects.

UNIT- I
Role of Engineers: Introduction, science, engineering, technology, engineer, scientist, role of engineer, various disciplines of engineering, misconception of engineering, expectations for the 21st century engineer and NBA graduate attributes.
Engineering problems and Design: Multidisciplinary facet of design, pair wise comparison chart, introduction to econometrics system, generation of multiple solution, Pugh chart, motor and battery sizing concepts, introduction to PCB design.

UNIT- II
Mechanisms: Basic components of a mechanism, degrees of freedom or mobility of a mechanism, 4-bar chain, crank rocker mechanism, slider crank mechanism, simple robotic arm building.
Platform-based development: Introduction to programming platforms (Arduino) and its essentials, sensors, transducers and actuators and their interfacing with Arduino.

UNIT- III
Data Acquisition and Analysis: Types of data, descriptive statistics techniques as applicable to different types of data, types of graphs and their applicability, usage of tools (MS-Office /Open Office/ Libre Office / Scilab) for descriptive statistics, data acquisition (temperature and humidity) using sensors interfaced with Arduino, exporting acquired data to spreadsheets, and analysis using representation.

UNIT- IV
Process Management: Introduction to Agile practice, significance of team work, importance of communication in engineering profession, project management tools, checklist, timeline, Gantt chart, significance of documentation.

UNIT -V
Engineering Ethics & Sustainability in Engineering: Identifying Engineering as a profession, significance of professional ethics, code of conduct for engineers, identifying ethical dimensions in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas.
Sustainability in Engineering: Introduction, sustainability leadership, life cycle assessment, carbon foot print.

Text Books:

1. Clive L. Dym, Patric Little, Elizabeth J Orwin, "Engineering Design: A project-based introduction", 4th edition, Willey.
2. Matthew Python, "Arduino programming for beginners", Independently published, 2020.
3. Patrick F. Dunn , "Measurement and data Analysis for engineering and science", third edition, 2014.
4. Andrew Stellman, Jennifer Greene, "Head First Agile: A brain-friendly guide to Agile principles, ideas, and real-world practices", Kindle Edition.

Suggested Reading:

1. Charles B. Fleddermann, “Engineering ethics”, fourth edition, Prentice Hall, 2012.
2. Rob Lawlor, “Engineering in society”, second edition, Royal academy of engineering.
3. Richard Dodds, Roger Venables, “Engineering for sustainable development: Guiding principles”, The Royal Academy of engineering, 2005.
4. Richard S. Paul, “Robot Manipulators: Mathematics, Programming, and Control”, MIT Press.

ENGINEERING EXPLORATION ASSESSMENT SCHEME				
S. No	**Name of the module**	**Work Hours**	**Marks**	**Evaluation**
1	Role of Engineers	4	-	Evaluation - I
2	Engineering Design	16	5	
3	Mechanisms	6	3	
4	Engineering Ethics	2	2	
5	Platform-based Development	16	5	Evaluation - II
6	Data Acquisition and Analysis	6	4	Evaluation-III
7	Project Management	4	4	
8	Sustainability in Engineering	6	2	
9	Course Project Reviews	12	20	Final Evaluation
10	Code of conduct	-	5	
	Total	**72**	**50**	

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
AICTE Model Curriculum (with effect from 2019-20)
B.E. (Information Technology)

Semester– III

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per Week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	18IT C04	Data Structures and Algorithms	3	-	3	30	70	3
2	18IT C05	Discrete Mathematics and Applications	3	-	3	30	70	3
3	18EC C34	Basic Electronics	3	-	3	30	70	3
4	18ME C09	Principles of Management	3	-	3	30	70	3
5	18EE C01	Basic Electrical Engineering	3/1	-	3	30	70	4
6	18CE M01	Environmental Science	2	-	2	-	50	Non-Credit
PRACTICALS								
7	18IT C06	Data Structures and Algorithms Lab	-	2	2	15	35	1
9	18IT C08	Mini Project – I	-	2	-	50	-	1
10	18EC C35	Basic Electronics Lab	-	2	2	15	35	1
11	18EG C03	Soft Skills	-	2	2	15	35	1
12	18EE C02	Basic Electrical Engineering Lab	-	2	2	15	35	1
		TOTAL	**17/1**	**10**	**-**	**260**	**540**	**21**

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE-Continuous Internal Evaluation **SEE-Semester End Examination**

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18IT C04

DATA STRUCTURES AND ALGORITHMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introducerepresentation, specification, and applications of various linear and nonlinear data structures.
2. To familiarize with asymptotic analysis of iterative and recursive functions.
3. To acquaint with various pattern matching algorithms.
4. To present different sorting algorithms.
5. To introduce hashing and collision handling.

Course Outcomes: Upon completing this course, students will be able to:

1. Provide optimal solutions using linear and nonlinear data structures.
2. Analyse time complexity of both iterative and recursive functions.
3. Perform pattern matching.
4. Understand various sorting algorithms and their performance
5. Understand hash functions and collision handling.

UNIT–I

Using Arrays, Storing Game Entries in an Array, Two-Dimensional Arrays. Singly Linked Lists, Implementing a Singly Linked List, Insertion to the front of a Singly Linked List, Removal from the front of a Singly Linked List. Doubly Linked Lists, Insertion into a Doubly Linked List, Removal from a Doubly Linked List, Circularly Linked Lists, Reversing a Linked List. Recursion, Linear Recursion, Binary Recursion, Multiple Recursion, Analysis of Algorithms.

UNIT–II

Stacks, the Stack Abstract Data Type, the STL Stack, A C++ Stack Interface, A Simple Array-Based Stack Implementation, Implementing a Stack with a Generic Linked List, Reversing a Vector Using a Stack, Matching Parentheses and HTML Tags, Queues,the Queue Abstract Data Type, the STL Queue, a C++ Queue Interface, a Simple Array-Based Implementation, Implementing a Queue with a Circularly Linked List. Double-Ended Queues, the Deque Abstract Data Type, the STL Deque, Implementing a Deque with a Doubly Linked List.

Lists, Node-Based Operations and Iterators, the List Abstract Data Type, STL Lists, STL Containers and Iterators.

UNIT–III

General Trees, Tree Definitions and Properties, Binary Trees. The Binary Tree ADT, A C++ Binary Tree Interface, Properties of Binary Trees, a Linked Structure for Binary Trees, a Vector-Based Structure for Binary Trees, Traversals of a Binary Tree, Representing General Trees with Binary Trees.

Pattern Matching Algorithms: Brute Force, the Boyer-Moore Algorithm, the Knuth-Morris-Pratt Algorithm. Tries, Standard Tries, Compressed Tries, Suffix Tries.

UNIT–IV

Binary Search Trees, Searching, Update Operations, C++ Implementation of a Binary Search Tree, AVL Trees, Update Operations, the Priority Queue Abstract Data Type: The Priority Queue ADT.

Merge-Sort, Divide-and-Conquer, Merging Arrays and Lists, Quick-Sort: Performing quick sort on arrays and lists. Linear-Time Sorting: Bucket-Sort and Radix-Sort, Comparing Sorting Algorithms.

The STL priority queue class, Implementing a Priority Queue with a List, Selection-Sort and Insertion-Sort, Heaps, The Heap Data Structure. Complete Binary Trees and their representation, Implementing a Priority Queue with a Heap, Heap Sort, Bottom-Up Heap Construction.

UNIT–V

Hash Tables, Bucket Arrays, Hash Functions, Hash Codes, Compression functions, Collision-Handling Schemes, Load Factors and Rehashing. Graphs, the Graph ADT, Data Structures for Graphs, the Edge List Structure, The Adjacency List Structure, The Adjacency Matrix Structure, Graph Traversals, Depth-First Search, Breadth First Search, Directed Graphs, Traversing a Digraph, Minimum Spanning Trees, Kruskal's Algorithm, The Prim-Jarn´ýk Algorithm.

Text Books:

1. Michael T. Goodrich, Roberto Tamassia, David M. Mount, "Data Structure and Algorithms in C++", 2nd Edition, John Wiley, 2011.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition Addison-Wesley, 2007.

Suggested Reading:

1. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", CareerMonk Publications, 2016.
2. Narasimha Karumanchi, "Data Structures and Algorithms for GATE", CareerMonk Publications, 2011.
3. D. Samantha, "Classic Data Structures", Prentice Hall India, 2nd Edition, 2013.

Web Resources:

1. http://nptel.ac.in/courses/106102064/1
2. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
3. https://visualgo.net/en

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18IT C05

DISCRETE MATHEMATICS AND APPLICATIONS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce Propositional and Predicate Logic Concepts.
2. To gain knowledge in Counting, Permutations and Combinations.
3. To facilitate learningRecurrence relations and Generating Functions.
4. To acquire knowledge in group theory.
5. To familiarize with Graph and Tree concepts.

Course Outcomes: Upon completing this course, students will be able to:

1. Symbolize the given sentence using predicate logic and propositional logic.
2. Apply permutations and combinations to handle different types of objects.
3. Solve recurrence relations using Generating Functions.
4. Understand semi group, monoid group and abelian group.
5. Apply Graph and Tree concepts for basic problem solving.

UNIT-I

Logic – Sets and Functions: Logic, Propositional equivalences – Predicates and Quantifiers – Nested Quantifiers-Rules of Inference-Sets-Set Operations, Functions.

Integers: The Integers and Division, Integers and Algorithms, Applications of Number Theory.

UNIT–II

Mathematical Reasoning, Induction, and Recursion: Proof Strategy, Sequence and Summation, Mathematical Induction, Recursive Definitions and Structural Induction, Recursive Algorithms.

Counting: Basics of Counting, Pigeonhole Principle, Permutations and Combinations– Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations.

UNIT–III

Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide and Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion–Exclusion, Application of Inclusion – Exclusion.

Relations: Relations & their Properties, N-ary Relations and Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings.

UNIT–IV

Algebraic Structures: Algebraic System - General Properties, semi groups, Monoids, Homomorphism, Groups, Residue arithmetic, group codes and their applications.

UNIT–V

Graphs: Graphs and Graph Models, Graph Terminology, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest Path Problems, Planar Graphs, Graph Coloring.

Trees: Introduction to Trees, Application of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

Text Books:

1. Kenneth H Rosen, “Discrete Mathematics and its applications”, 6th Edition, McGraw Hill, 2006.
2. R.K. Bishit, H.S. Dhami, “Discrete Mathematics”, Oxford University Press, 2015.

Suggested Reading:

1. J.P.Trembly, R.Manohar, “Discrete Mathematical Structure with Application to Computer Science”, McGraw- Hill, 1997.
2. J. K. Sharma, “Discrete Mathematics”, 2nd Edition, Macmillan, 2005.
3. Joel. Mott.Abraham Kandel, T.P.Baker, “Discrete Mathematics for Computer Scientist &Mathematicans”, Prentice Hall.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18_cs53/
2. https://www.coursera.org/learn/discrete-mathematics

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18EC C34

BASIC ELECTRONICS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Describe semiconductor devices principle and to understand the characteristics of junction diode and transistors.
2. Understand working principles of Oscillators and Amplifiers.
3. Understand the working principle of the regulators and transducers.

Course Outcomes: Upon completion of this course, students will be able to:

1. Use semiconductor devices in making circuits like rectifiers, filters, regulators etc.
2. Design amplifier and oscillators
3. Compare various types of power amplifiers.
4. Analyze the principles and practices for instrument design to development the real world Problems.
5. Apply concepts of various electronic circuits.

Prerequisite: Knowledge about semiconductor physics and basic electrical engineering

UNIT-I

Semiconductor Theory: Energy levels, Intrinsic and Extrinsic Semiconductor, Mobility, Diffusion and Drift current, Hall effect, Law of mass action, Characteristics of P-N Junction diode, current equation, Parameters and Applications.

Rectifiers: Half wave and Full wave Rectifiers Bridge and center tapped with and without filters, Ripple factor, regulation and efficiency.

UNIT-II

Transistors: Bipolar and field effect transistors with their h-parameter equivalent circuits, Basic Amplifiers classification and their circuits (Qualitative treatment only).

Regulators and Inverters: Zener Diode**,** Breakdown mechanisms, Characteristics, Effect of Temperature, Application as voltage regulator.

UNIT-III

Feedback Amplifiers: Properties of Negative Feedback Amplifier, Types of Negative Feedback, Effect of negative feedback on Input impedance and Output impedance, Applications (Qualitative treatment only).

Oscillators: principle of oscillations, LC Type-Hartley, Colpitt and RC Type-Phase shift, Wien Bridge and Crystal Oscillator (Qualitative treatment only).

UNIT-IV

Operational Amplifiers: Basic Principle, Ideal and practical Characteristics and Applications-Summer, Integrator, Differentiator, Instrumentation Amplifier.

Power Amplifiers: Operation of Class A, Class B, Class AB and Class C power amplifiers.

UNIT-V

Data Acquisition systems: Study of transducers-LVDT, Strain gauge.

Photo Electric Devices and Industrial Devices: Photo diode, Photo Transistor, LED, LCD, SCR, UJT Construction and Characteristics and their applications only.

Display Systems: Constructional details of C.R.O and Applications.

Text Books:

1. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuits Theory”, Pearson Education, 9th Edition, LPE, Reprinted, 2006.
2. Morris Mano, “Digital Design”, Pearson Education, Asia 2002.

Suggested Reading:

1. Jacob Millman and C., Halkias, “Electronic Devices”, McGraw Hill, 8th Edition, Reprint1985.
2. Ramakanth A. Gayakwad, “Op-Amps and Linear Integrated Circuits”, Prentice Hall of India, 3rd Edition,1985.
3. W. D. Cooper, A. Helfric, “Electronic Instrumentation and Measurement Techniques”, PHI, 4th Edition,2010.

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18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To make the students to

1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

Course Outcomes: At the end of the course, student will be able to understand

1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT–I

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues inmanagement

UNIT–II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT–III

Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human

resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT–IV

Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT–V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, "Management", 10th Edition,Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, "Management", 6th Edition, Pearson Education,2004.

Suggested Reading:

1. P.C. Tripathy & P.N.Reddy, "Principles of Management", Tata McGraw Hill, 1999.
2. Harold Koontz and Cyril O'Donnell "Principles of Management", Tata McGraw Hill, 2017.

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18EE C 01

BASIC ELECTRICAL ENGINEERING

Instruction	3 L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.
3. To understand the basic principle of operation of Transformer and DC machines.
4. To understand the basic principle of operation of DC machines and AC machines.
5. To know about different types of electrical wires and cables, domestic and industrial wiring.
6. To understand safety rules and methods of earthing.

Course Outcomes: At the end of the course, the student will be able to

1. Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits.
2. Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits.
3. Acquire the concepts of principle of operation of Transformers and DC machines.
4. Acquire the concepts of principle of operation of DC machines and AC machines.
5. Acquire the knowledge of electrical wiring and cables and electrical safety precautions.
6. Recognize importance of earthing and methods of earthing and electrical installations.

UNIT–I

DC Circuits Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of firstorder RL and RC circuits.

UNIT–II

AC Circuits Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT–III

Transformers Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation, Auto transformer.

UNIT–IV

DC and AC Machines DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators. DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors. Three - Phase Induction Motors: Construction, Principle of operation, Torque equation, torque-slip characteristics, Power stages, speed control of induction motors.

UNIT–V

Electrical Installations Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Earthing, Elementary calculations for energy consumption.

Text Books:

1. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
3. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill,2009
4. P.V.Prasad, S.sivanagaraju, R.Prasad, "Basic Electrical and Electronics Engineering", Cengage Learning, 1st Edition, 2013.

18CE M 01

ENVIRONMENTAL SCIENCE

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: To enable the student:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: At the end of the course, the student should have learnt

1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT–I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT–II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem,

food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT–III

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT–IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT–V

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria& Sons, 2009.

Suggested Reading:

1. C. S. Rao," Environmental Pollution Control Engineering", Wiley, 1991.
2. S. S. Dara, "A Text Book of Environmental Chemistry & Pollution Control", S. Chand Limited, 2006.

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18IT C06

DATA STRUCTURES AND ALGORITHMS LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To introduce linked lists and operations.
2. To present Stacks, Queues and their applications.
3. To familiarize pattern matching algorithms.
4. To introduce Sorting algorithms and Hashing.
5. To gain knowledge of trees, graphs and related algorithms.

Course Outcomes: Upon completing this course, students will be able to:

1. Implement linked lists.
2. Develop ADT necessary for solving problems based on Stacks and Queues.
3. Perform pattern matching.
4. Implement various Sorting Algorithms and Hashing.
5. Identify data structures suitable for providing optimal solutions to real world problems.

List of Programs

1. Define Single Linked List ADT and implement its operations.
2. Define Double Linked List ADT and implement its operations.
3. Implement Stack ADT and perform Infix to Postfix Conversion.
4. Perform evaluation of postfix expression using Stack ADT.
5. Implement Queues, Circular Queues and Deques using arrays and linked lists.
6. Define String ADT and implement Boyer Moore pattern matching algorithm.
7. Implement Tries.
8. Implement the following: Insertion Sort, Bubble Sort, Selection Sort, and Shell Sort.
9. Implement the following: Merge Sort, Quick Sort, Heap Sort, and Binary Search.
10. Construct a Binary Search Tree and implement Tree Traversal techniques.

11. Implement Hashing with chaining.
12. Implement Graph traversal techniques.

Text Books:

1. Narasimha Karumanchi, “Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles”, CareerMonk Publications, 2016.
2. Michael T. Goodrich, Roberto Tamassia, David M. Mount, “Data Structure and Algorithms in C++”, 2^{nd} Edition, John Wiley, 2011.

Suggested Reading:

1. Narasimha Karumanchi, “Coding Interview Questions”, CareerMonk Publications, 3^{rd} Edition, 2016
2. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Addison-Wesley, 3^{rd} Edition, 2007.
3. D. Samantha, “Classic Data Structures”, Prentice Hall India, 2^{nd} Edition, 2013.

Web Resources:

1. https://leetcode.com/
2. https://www.hackerearth.com/practice/data-structures/arrays/1-d/tutorial/
3. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

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18IT C08

MINI PROJECT – I

Instruction	2 Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

Course Objectives:
1. To enable students learn by doing.
2. To develop capability to analyse and solve real world problems
3. To develop innovative ideas among the students

Course Outcomes: Students should be able to do the following:
1. To provide innovative solutions
2. To work in a team
3. To manage time and resources in the best possible manner

The Students are required to choose a topic for miniproject related to the courses of this semester. The student has to implement and present the project as per the given schedule. During the implementation of the project, Personnel Software Process (PSP) has to be followed. Report of the project work has to be submitted for evaluation.

Schedule

S.No	Description	Duration
1.	Problem Identification / Selection	2 weeks
2.	Preparation of Abstract	1 week
3.	Design, Implementation & Testing of the Project	7 weeks
4.	Documentation & Project Presentation	4 weeks

Guidelines for the Award of marks

S.No.	Description	Max. Marks
1.	Weekly Assesment	20
2.	PPT Preparation	05
3.	Presentation	10
4.	Question and Answers	05
5.	Report Preparation	10

Final MiniProject demonstration and PPT presentation is to be evaluated for the entire class together by all the faculty handling MiniProject for that class.

18ECC 35

BASIC ELECTRONICS LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: This course aims to:
1. Learn about various electronic components and devices.
2. Study the transistor characteristics in different modes.
3. Learn about oscillators and amplifiers.

Course Outcomes: Upon completion of this course, students will be able to:
1. Familiarize on basic electronic components, devices and system.
2. Analyze the measurements of time period, amplitude and phase of different waveforms.
3. Design and analyze the behavior of the regulator and rectifier.
4. Develop various types of oscillators and power amplifiers
5. Design the various circuits using operational amplifiers.

Prerequisite: Knowledge about semiconductor physics and basic electrical engineering.

List of Experiments
1. Study of Electronic components.
2. Characteristics of Semiconductor diodes (Ge, Si and Zener).
3. CRO and its Applications.
4. Half, Full wave rectifiers with and without filters.
5. Voltage Regulator using zener diode.
6. Characteristics of BJT in CE Configuration.
7. Characteristics of FET in CS Configuration.
8. Amplifier with and without feedback.
9. RC Phase shift oscillator
10. Operational Amplifier and its applications.
11. Power Amplifiers Characteristics
12. Realization of Half and Full adder

Text Books:
1. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, “Basic Electronics,a Text - Lab Manual”, 7th Edition, TMH, 1994.
2. Paul B. Zbar, “Industrial Electronics, a Text - Lab Manual”, 4th Edition, 2008.

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18EG C03

SOFT SKILLS

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The course will introduce the students to:

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes : After successful completion of the course the students will be able to:

1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise 1

Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)
Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise 2

Main Topics: Advanced Group Discussion with Case studies: Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)
Writing Input: Writing with Precision - Writing Abstracts

Exercise 3

Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions & Practice)
Writing Input: Writing to Reflect - Resume Writing

Exercise 4

Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity
Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)
Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5

Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)
Writing Input: Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte , "**A Course in English communication**", Prentice-Hall of India, 2007.
2. Dr. Shalini Verma, **"Body Language- Your Success Mantra**", S Chand, 2006.
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "**The ACE of Soft Skills",** New Delhi: Pearson, 2010.
4. Van Emden, Joan, and Lucinda Becker, "**Presentation Skills for Students**", New York: Palgrave Macmillan, 2004.

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

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18EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements.
2. To verify the basic electrical circuit laws and theorems.
3. To determine the parameters and power factor of a coil.
4. To calculate the time and frequency responses of RLC circuits
5. To determine the characteristics of Transformers.
6. To determine the characteristics of dc and ac machines.

Course Outcomes: At the end of the course, the students are expected to

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer.
6. Understand the basic characteristics of dc and ac machines. List of Laboratory

Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components
2. Verification of KCL and KVL.
3. Time response of RL and RC circuits.
4. Calculation of permittivity of a choke or coil by Wattmeter Method.
5. Verification of Thevenin's and Norton's theorems.
6. Turns ratio /voltage ratio verification of 1-Ph Transformers.
7. OC and SC tests on a given 1-Ph Transformer.
8. Observation of Excitation Phenomenon in Transformer.
9. Measurement of 3-Ph power in a balanced system (By 2- Wattmeter method).
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle).

11. Load test of DC Shunt motor.
12. Speed control of DC Shunt motor.
13. Load test of 3-Ph Induction motor.
14. Demonstration of LT Switchgear Equipment/Components.
15. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: At least TEN experiments should be conducted in the semester.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
AICTE Model Curriculum (with effect from 2019-20)
B.E. (Information Technology)

Semester– IV

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per Week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	18IT C03	Digital Logic and Computer Architecture	3	-	3	30	70	3
2	18IT C09	Database Management Systems	3	-	3	30	70	3
3	18IT C10	Java Programming	2	-	2	20	50	2
4	18IT C11	Design and Analysis of Algorithms	3	-	3	30	70	3
5	18MT C09	Probability and Statistics	3/1	-	3	30	70	4
6	18EG M01	Indian Constitution	2	-	2	-	50	Non - Credit
PRACTICALS								
8	18IT C07	IT Workshop	-	2	-	50	-	1
9	18IT C12	Database Management Systems Lab	-	2	2	15	35	1
10	18IT C13	Java Programming Lab	-	2	2	15	35	1
8	18IT C14	Mini Project - II	-	2	-	50	-	1
		TOTAL	16/1	8	-	270	450	19

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE-Continuous Internal Evaluation **SEE-Semester End Examination**

18IT C03

DIGITAL LOGIC AND COMPUTER ARCHITECTURE

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To familiarize with logic gates, combinational and Sequential logic circuits.
2. To provide understanding of Data representation.
3. To present the operation of the Central Processing Unit.
4. To facilitate with the techniques that computers use to communicate with input and output devices.
5. To introduce the concept of memory hierarchy and memory management.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand simplification of logic gates,fundamentals of combinational and sequential logic gates.
2. Design of registers, counters and representation of data using numbers.
3. Understand the architecture and functionality of central processing unit.
4. Discuss the techniques that computers use to communicate with I/O devices for data transfer.
5. Comprehend memory hierarchy, cache memory and virtual memory.

UNIT–I

Digital Logic Circuits : Digital Computers, Logic Gates, Boolean Algebra, Map simplification, Product –of-sums Simplification, Don't –Care Conditions, Combinational Circuits , Half-Adder, Full –Adder, Flip-Flops: SR,D,JK,T Flip-Flops, Edge triggered Flip-Flops, Excitation Tables, Digital Components: Integrated circuits, Decoders. Encoders, Multiplexers

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UNIT–II

Registers: Register with Parallel load, Shift Register, Counters. **Data Representation:** Data Types, Number Systems, Octal and Hexadecimal Numbers, Decimal Representation, Alphanumeric Representation, Complements: (r-1)'s Complement, r's Complement, Subtraction of Unsigned Numbers, Fixed–Point Representation, Floating –Point Representation, Other Binary Codes, Error Detection Codes.

UNIT–III

Central Processing Unit: General register Organization, Stack Organization: Register Stack, Memory Stack, Reverse Polish Notation, Instruction Formats: ThreeAddress Instructions, Two-Address Instructions, One-Address Instructions, Zero-Address Instructions, RISC Instructions, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC): CISC Characteristics, RISC Characteristics.

UNIT–IV

Input-Output Organization: Peripheral Devices: ASCII AlphanumericCharacters, Input-output Interface: I/O Bus and Interface Modules, Asynchronous Data Transfer: Strobe Control, Handshaking, Asynchronous Communication Interface, First-In- First-Out Buffer, Modes of Transfer: Interrupt-Initiated I/O, Priority Interrupt: Daisy Chaining Priority, Parallel Priority Interrupt, Priority Encoder, Direct Memory Access (DMA): DMA Controller.

UNIT–V

Memory Organization: Memory Hierarchy, Main Memory: RAM and ROM Chips, Memory Address Map, Memory Connection to CPU, Auxiliary memory: Magnetic Disks, Magnetic Tapes, Associative Memory: Hardware Organization, Match Logic, Read and Write Operations, Cache Memory: Associative Mapping, Direct Mapping, Set-Associative Mapping, Virtual Memory: Address Space and Memory Space, Address Mapping using Pages, Associative Memory Page Table, Page Replacement.

Text Book:

1. M.Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education.

Suggested Reading:

1. Stephen Brown, ZvonkoVranesic, "Fundamentals of Digital Logic with VHDL design", 2nd Edition, McGraw Hill, 2009.

2. ZVI Kohavi, "Switching and Finite Automata Theory", 2nd Edition, Tata McGraw Hill, 1995.
3. William Stallings, "Computer Organization and Achitecture", 8th Edition,PHI.
4. Carl Hamachar, Vranesic, Zaky, "Computer Organization", 5th Edition, McGraw Hill.

Web Resources:

1. https://nptel.ac.in/courses/117106114Week1%20Slides1.1Introduction.pdf
2. https://ece.gmu.edu/coursewebpages/ECE/ECE545/F10/viewgraphs/ECE545_lecture1_digital_logic_review.ppt
3. http://www.nptelvideos.in/2012/11/computer-organization.html

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18IT C09

DATABASE MANAGEMENT SYSTEMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce the fundamental concepts and the role of a database system in an organization.
2. To acquire knowledge on Data base design models, constraints and notations.
3. To familiarize with querying databases using SQL.
4. To acquaint with design and implementation issues of a database system.
5. To discuss the concepts of database security, concurrency and recoverability.

Course Outcomes: Upon completing this course, the students will be able to:

1. Understand the purpose of database systems and design any domain specific database using E-R model.
2. Design and implement a database using Relational data model, formulate Relational algebra expressions. Use SQL for efficient data retrieval queries.
3. Access databases from high level languages, define triggersand apply normalization.
4. Efficiently organize and manage data using indexing and hashing.
5. Understand the conceptsof database transactions, locking protocols, concurrency control, backup and recovery.

UNIT–I

Introduction: Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval Specialty Databases, Database User and Administrators. **Database Design and the E-R Model:** Overview of the Desig Process, the EntityRelationship Model, Constraints, Removing Redundan Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relationa

Schemas, Entity-Relationship Design Issues, Extended E-R Features, Alternative Notations for Modeling Data.

UNIT–II

Introduction to the Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations. **Introduction to SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database. **Intermediate SQL:** Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization.

UNIT–III

Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, Advanced Aggregation Features. **Relational Database Design:** Features of Good Relational, Designs, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Functional-Dependency Theory,Algorithms for Decomposition, Decomposition using Multivalued Dependencies.

UNIT–IV

Indexing and Hashing: Basic Concepts, Ordered Indices, B+ Tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Index Definition in SQL **Transactions:** Transaction Concept, a Simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels.

UNIT–V

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes, Snapshot Isolation, Insert Operations, Delete Operations and Predicate Reads. **Recovery System:** Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, ARIES, Remote Backup Systems.

Text Book:

1. Abraham Silberschatz, Henry F Korth, S. Sudarshan, "Database System Concepts", 6th Edition, McGraw-Hill International Edition, 2010.

Suggested Reading:

1. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database System", 6th Edition, Addison-Wesley, 2011.
2. Raghu Ramakrishnan,JohannesGehrke, "Database Management Systems", 3rd Edition, McGraw-Hill International Edition, 2014
3. Rick F Vander Lans, "Introduction to SQL", 4th Edition, Pearson Education, 2007.
4. Benjamin Rosenzweig, Elena Silvestrova, "Oracle PL/SQL by Example", 5th Edition, Pearson Education, 2015.

Web Resources:

1. http://db-book.com/
2. https://www.tutorialspoint.com/dbms/
3. https://www.w3schools.in/dbms/
4. http://www.oracle-dba-online.com/sql/oracle_sql_tutorial.htm.
5. http://www.tutorialspoint.com/plsq

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18IT C10

JAVA PROGRAMMING

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	20 Marks
Credits	2

Course Objectives:

1. To familiarize with fundamentals of object-oriented programming paradigm.
2. To impart the knowledge of string handling, interfaces, packages and inner classes.
3. To acquaint with Exception handling mechanisms and Multithreading.
4. To gain knowledge on collection framework, stream classes.
5. To familiarize with event driven GUI and Database connectivity.

Course Outcomes: After successful completion of this course, student will be able to:

1. Understand object-oriented concepts.
2. Create Java applications using best OOP practices e.g. Inheritance, interfaces, packages, and inner classes.
3. Implement the concepts of Exception Handling and Multi threading.
4. Develop applications using Collections framework.
5. Design and Develop GUI applications with JDBC.

UNIT–I

Introduction to Java: Objects, Classes, structure a java program, difference betweenjdk and jre, Java Primitive Types, Basic Operators, Conditional and Logical statements.

Defining Classes: Adding Instance Fields and Methods, Constructors, Access Modifiers (Visibility Modes), Object Creation Examples, Method Overloading and Constructor Overloading, Use of static andfinalkeywords, Objects as parameters, Difference between local variable and instance field, importance of Object class.

UNIT–II

Inheritance, Interfaces and Packages in Java: Defining super / sub classes, Abstract classes, Method overriding, Interfacesand new features in latest version.

Packages: Defining, Creatingand Accessing a Package, importing packages.

Arrays,StringsinJava: Howtocreateanddefinearrays,Introductionto java.util. Array class, Difference between String &String Buffer classes, String Tokenizer class and Wrapperclassesandconversionbetween Objects and primitives, Autoboxing and unboxing

Inner classes in Java: Types of inner classes, Creating static / non-static inner classes, Local and anonymous innerclasses.

UNIT–III

Exception Handling in Java: What are exceptions, Error vs. Exception, usage of try, catch, throw throws and finally clauses, writing your own exception classes, Difference between checked vs. unchecked Exceptions.

Generics: Need of Generics concept, Generic classes, bounded types, Generic methods and interfaces.**Multithreading in Java:** The java Thread Model, How to create threads, Thread class in java, Thread priorities, Inter thread communication, Thread synchronization.

UNIT–IV

Collections: Overview of Java Collection Framework, Collection Interfaces – Collection, Set, List, Map, Commonly used Collectionclasses – ArrayList, LinkedList, HashSet, TreeSet, HashMap, TreeMap, legacy and class, Iteration over Collections – Iterator and ListIterator, Enumeration interfaces, differentiate Comparable and Comparator

File Handling: Stream classes, Reader and Writer classes, File and Directory class, How to read user input fromkeyboard. New Features in java 8 and 9

UNIT–V

GUI Design & Event Handling: Component, Container, Color,GUI Controls, Layout Managers, Introduction to Swings, Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. Handlingbutton click, mouse and keyboard events, and Adapter classes. Writing GUI Based applications, Applets, life cycle of an Applet, Developing and running applets, passing parametersto applets.

Database Handling in Java: Java Database Connectivity (JDBC) using MySQL.

Text Books:

1. Herbert Schildt, “Java: The Complete Reference”, 8^{th} Edition, TataMcGraw Hill Publications, 2011.
2. Cay S. Horstmann, Gary Cornell,”Core Java, Volume I— Fundamentals”, 8^{th} Edition, Prentice Hall, 2008.

Suggested Reading:

1. Sachin Malhotra, Saurabh Choudhary, “Programming in Java”, Oxford University Press, 2^{nd} Edition, 2014.
2. C.ThomasWu, “An Introduction to Object-Oriented Programming with Java”, TataMcGraw-Hill, 4^{th} Edition, 2010.

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html
2. https://nptel.ac.in/courses/106106147/2
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

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18IT C11

DESIGN AND ANALYSIS OF ALGORITHMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To analyze the performance of various algorithms.
2. To illustrate different paradigms of problem solving.
3. To learn about various algorithm design techniques and illustrates them using a number of well known problems and applications.
4. To familiarize graph traversal and search techniques.
5. To discuss NP hard and NP complete problems and their applications.

Course Outcomes: Upon completing this course, students will be able to:

1. Analyse best, average and worst case complexities of algorithms and choose appropriate data structure for designing algorithm.
2. Design solutions using Divide and Conquer, Greedy techniques.
3. Design algorithms using dynamic programming approach, apply various traversal and search techniques.
4. Design algorithms using backtracking, branch and bound techniques.
5. Identify P, NP, NP-Complete and NP-Hard classes to which an algorithm belongs and design a feasible solution.

UNIT-I

Introduction: Algorithm Specification, Performance analysis: Space Complexity, Time Complexity, Asymptotic Notation (O, Omega, Theta), Practical Complexities, Performance Measurement, **Elementary Data Structures:** Stacks and Queues, Trees, Dictionaries , Priority Queues, Sets and Disjoint Set Union.

UNIT-II

Divide and Conquer: The general method, Finding the Maximum and Minimum, Merge Sort, Quick Sort, Selection Sort, Strassen's Matrix Multiplication.
Greedy Method: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees, Optimal Storage on Tapes, Optimal Merge Patterns, Single Source Shortest Paths.

UNIT-III

Dynamic Programming: The General Method, Multistage graphs, All Pair Shortest Paths, Single Source Shortest Paths, Optimal Binary Search Trees, 0/1 Knapsack, Reliability Design, The Traveling Salesperson Problem.
Traversal and Search Techniques: Breadth First Search and Traversal, Depth First Search and Traversal, Connected Components and Spanning Trees, Bi-connected Components and DFS.

UNIT-IV

Backtracking: The General Method, 8-Queens Problem, Graph Colouring, Hamilton cycles, Knapsack Problem.
Branch and Bounds: The Method: Least Cost (LC) Search, The 15 puzzle, FIFO Branch and Bound, LC Branch and Bound, 0/1 Knapsack Problem, Traveling Salesperson Problem.

UNIT-V

NP-Hard and NP-Complete Problems: Basic Concepts: Non-Deterministic Algorithms, the Classes NP Hard and NP Complete. Cook's theorem, NP-Hard Graph Problems: Node Cover Decision Problem, Chromatic Number Decision Problem, Directed Hamiltonian Cycle, Traveling Salesperson Decision Problem, NP Hard Scheduling Problems: Job Shop Scheduling.

Text Books:

1. Ellis Horowitz, Sartaj Sahani, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithm, 2nd Edition", Universities Press, 2011.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 2nd Edition, Prentice Hall of India Private Limited, 2006.

Suggested Reading:

1. AnanyLevitin, "Introduction to the Design & Analysis of Algorithms", Pearson Education, 2003.
2. Aho, Hopcroft, Ullman, "The Design and Analysis of Computer Algorithm", Pearson Education, 2000.
3. Parag H.Dave, Himanshu B. Dave, "Design and Analysis of Algorithms", 2nd Edition, Pearson Education, 2014.

Web Resources:

1. http://nptel.ac.in/courses/ 106101060
2. http://nptel.ac.in/courses/106106131

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18MT C09

PROBABILITY AND STATISTICS

Instruction	3 L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. Able to learn and Analysing data in Linear and Non-Linear form.
2. Able to fit the hypothetical data using probability distribution.
3. Understand the data using the testing of Hypothesis.
4. Able to Analysing time series data using trend analysis.
5. Able to formulate and get the solution of real world problem.

Course Outcomes: On successful completion of this course the students shall be able to

1. Use the principle of Least Squares approximating for estimating the value.
2. Use the basic probability for fitting the Random phenomenon.
3. Analysing data using different methods of hypothesis testing.
4. Use the Moving Averages Methods for trend analysis.
5. Analyse the random phenomena of real world data.

UNIT-I

Basic Statistics: Measures of Central Tendency, Measures of Dispersion, Skewness (SKP & SKB) for frequency distribution, Kurtosis, Curve fitting by the Method of Least Squares, Fitting of Straight lines, Second degree parabola and Growth curve ($y = ae^{bx},\ y = ax^{b}\ \ and\ \ y = ab^{x}$).

UNIT-II

Discrete Probability Distributions: Basic probability, Conditional probability, Bayes theorem, Random variable, Discrete random variable, continuous random variable, Properties of probability mass function, probability density function, Mathematical expectation variance, co-variance and properties, Poisson distribution, Poisson Distribution is a limiting form of Binomial Distribution), MGF, CGF, fitting of Poisson distribution.

UNIT-III

Continuous Probability Distribution and Bivariate Distribution: Continuous probability distribution-Normal distribution-Standard Normal random variable (MGF, Expectation, Variance, Properties of Normal Curve)-Areas under Normal curve-Exponential distribution (MGF, CGF, Expectation, Variance)-Uniform distribution (MGF, Expectation, Variance)-Bivariate data two dimensional Discrete random variable, continuous random variable, Marginal probability function, Properties of joint probability function-sum and differences.

UNIT-IV

Small Sample Test: Inferential statistics-Test of significance-Large sample test for single proportion, difference of proportions, single mean, difference of means and differences of standard deviations. Small sample test-test for single mean, differences of Means, test for ratio of variances, Chi-Square test for goodness of fit and independent of attributes.

UNIT-V

Time Series Analysis and ANOVA: One way classification-Assumptions for ANOVA Test-ANOVA for fixed effect model-Two way classification-ANOVA for fixed effect model-Components of Time series-Measurement of Trend-Method of semi Averages- Moving Averages Method (3 Years and 5 Years).

Text books:

1. S.C.Gupta, V.K.Kappoor, “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons, 2014.
2. S.C.Gupta, V.K.Kappoor, “Fundamentals of Applied Statistics”, Sultan Chand and Sons, 2014.
3. Sheldon Ross, “A First Course in Probability”, 9th Edition, Pearson publications, 2014.

Suggested Reading:

1. W. Feller, “An Introduction to Probability Theory and its Applications”, Vol. 1, 3rd Edition, Wiley, 1968.

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18EG M01

INDIAN CONSTITUTION

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks

Course Objectives: The course will introduce the students to:

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indiannationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: After successful completion of the course the students will be able to :

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operativeSocieties.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right To Liberty.

UNIT-I

Constitution of India: Introduction and salient features, Constitutional history. Directive Principles of State Policy - Its importance and implementation.

UNIT-II

Union Government and its Administration: Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States.

Parliamentary form of government in India. President: role, power and position.

UNIT-III

Emergency Provisions in India: National emergency, President rule, Financial emergency

UNIT-IV

Local Self Government: District's Administration Head: Role and Importance.

Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

UNIT-V

Scheme of The Fundamental Rights & Duties: Fundamental Duties - The legal status.

Scheme of The Fundamental Rights - To Equality, to certain Freedom Under Article 19, to Life And Personal Liberty Under Article 21.

Suggested Reading:

1. The Constitution of India, 1950 (Bare Act), GovernmentPublication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition,2015.
3. M. P. Jain, Indian Constitution Law, 7th Edition, Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis,2015.

Web Resource:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

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18IT C07

IT WORKSHOP

Instruction	2 Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

Course Objectives:
1. To understand the basic components and peripherals of a computer.
2. To become familiar in configuring a system.
3. To impart the usage of productivity tools.
4. To acquire knowledge about the netiquette and plagiarism.
5. To get hands on experience in LATEX.

Course Outcomes: Upon successful completion of the course students will be able to:
1. Identify the basic components and peripherals of a computer.
2. Installation of Operating System and various Device Drivers.
3. Work on MS Office Packages.
4. Understand Net etiquette and Plagiarism tools.
5. Create documents using LATEX.

List of Experiments
1. System Assembling, Disassembling and identification of Parts / Peripherals.
2. **Operating System Installation** - Install Operating Systems like Windows, Linux along with necessary Device Drivers.
3. **MS-Office:Word** - Formatting, Page Borders, Reviewing, Equations, symbols. **Spread Sheet** - organize data, usage of formula, graphs, charts.**Power point** - features of power point, guidelines for preparing an effective presentation.
4. **Essentials:** Search Engines & Net etiquette, Plagiarism, Open source tools and other Utility Tools.
5. **LATEX** - basic formatting, handling equations and images.

Text Books:

1. K.L. James, "Computer Hardware, Installation, Interfacing, Troubleshooting and Maintenance", Eastern Economy Edition.

2. Gary B. Shelly, Misty E. Vermaat, Thomas J. Cashman, "Microsoft Office 2007: Introductory Concepts and Techniques", Windows XP Edition, 2007.
3. Leslie Lamport," LATEX- User's Guide and Reference manual", 2nd Edition, Pearson, LPE.

Suggested Reading:

1. Scott. Mueller, "Scott Mueller's Upgrading and Repairing PCs", 18th Edition, QUE, Pearson,2008.
2. Cheryl A Schmidt, "The Complete Computer upgrade and repair book", 3rd Edition, Dreamtech.

Web Resources:
1. https://en.wikibooks.org/wiki/How_To_Assemble_A_Desktop_PC/Assembly
2. https://www.auburn.edu/citizenship/netiquette.html
3. https://tex.stackexchange.com/questions/79051/how-to-style-text-in-hyperref-url

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18IT C12

DATABASE MANAGEMENT SYSTEMS LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To introduce the basic commands of SQL, functions and procedures.
2. To familiarize with query processing.
3. To impart knowledge on triggers and DML.
4. To introduce database security methods.
5. To familiarize with design and development of database applications.

Course Outcomes: Upon completion of this course, the students will be able to:

1. Design and implement database schemas by enforcing integrity constraints.
2. Use SQL for database administration, data manipulation and retrieval.
3. Write PL/SQL programs, define triggers and cursors for the databases.
4. Enforcesecurity features for database applications.
5. Design, Create Forms and Reports from multiple tables.

List of Programs

1. Creation of database (Exercising commands like DDL and DML) (Note: use constraints while creating tables).
2. Exercising simple to complex queries
   a. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSECT Constraints.
   b. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING clause and Creation and dropping of Views.
   c. Exercising all types of Joins.
3. Demonstration of PL/SQL Blocks and Cursors.
4. Demonstration of Procedures and Functions.
5. Usage of Triggers (BEFORE and AFTER Triggers, Row and Statement level Triggers and INSTEAD OF Triggers).
6. Demonstrate Exception Handling by PL/SQL procedures for data validation.
7. Creating Password and Security features for applications.

8. Usage of File locking, table locking facilities in applications.
9. Creation of Forms and Generation of SQL reports.
10. Creation of full-fledged database application spreading over to 3 sessions

Text Books:

1. Rick F Vander Lans, "Introduction to SQL", 4th Edition, Pearson Education, 2007.
2. Benjamin Rosenzweig, Elena Silvestrova, "Oracle PL/SQL by Example", 5th Edition, Pearson Education, 2015.
3. Alan Beaulieu, "Learning SQL",2nd Edition,O'Reilly,2009.

Suggested Reading:

1. Albert Lulushi, "Oracle Forms Developer's Handbook", Pearson Education, 2006.

Web Resources:

1. http://www.oracle-dba-online.com/sql/oracle_sql_tutorial.htm
2. https://www.javatpoint.com/pl-sql-tutorial

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18IT C13

JAVA PROGRAMMING LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To gain the fundamental programming knowledge of OOPs.
2. To use Exception handing mechanisms in application development.
3. To provide the knowledge of generics and Collections Framework.
4. To acquaint with GUI design and Event hanling using AWT andSwing.
5. To provide the knowledge of writing applications using JDBC.

Course Outcomes: After successful completion of this course, student will be able to:

1. Develop Java applications using the concepts of Inheritance, interfaces, packages and access controlspecifiers.
2. ImplementtheconceptsofExceptionHandling and Multithreading injavaApplications.
3. Read and write data using different Java I/Ostreams.
4. Develop applications using Collections framework.
5. Create GUI applications using AWT, Swing Packages withJDBC.

List of Programs

1. Program(s) to illustrate the concepts of constructor overloading, method overloading, static and final keywords usage.
2. Program(s) to illustrate the concepts of Inheritance, method overriding, super keyword usage, and Dynamic polymorphism.
3. Program(s) to illustrate concept of abstract class &interfaces.
4. Program(s) to demonstrate Stringhandling with String, StringBuffer and StringTokenizer classes.
5. Program(s) to demonstrate various types of inner classes, Packages creation and usage.
6. Program(s) to demonstrate concept of exception handling and user definedexceptions.
7. Program(s) to demonstrate concept of Multithreading and Thread synchronization.

8. Program(s) using Generics, Collection framework classes and Interfaces.
9. Porograms(s) on Comparator and Comparableinterfaces to define customized sorting order on collection objects.
10. Program(s) to illustrate the usage of I/O streams.
11. Program(s) toillustrate GUI with different controls, eventhandling and applets.
12. Program to connect to a database using JDBC using various databases.

Text Books:

1. HerbertSchildt, “Java:The Complete Reference”, 8th Edition,Tata McGraw Hill Publications,2011.
2. Cay S. Horstmann, Gary Cornell: “Core Java, Volume I—Fundamentals”, 8th Edition, Prentice Hall, 2008.

Suggested Reading:

1. Sachin Malhotra, Saurabh Choudhary: “Programming in Java”, Oxford University Press, 2nd Edition, 2014.
2. C. Thomas Wu, “Anintroduction to Object - Oriented Programming with Java”, Tata Mc Graw- Hill Publishing company Ltd., 4th Edition, 2010.

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html
2. https://nptel.ac.in/courses/106106147/2
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

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18IT C14

MINI PROJECT – II

Instruction	2 Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

Course Objectives:

1. To enable students learn by doing.
2. To develop capability to analyse and solve real world problems
3. To develop innovative ideas among the students

Course Outcomes: Students should be able to do the following:

1. To provide innovative solutions
2. To work in a team
3. To manage time and resources in the best possible manner

The Students are required to choose a topic for miniproject related to the courses of this semester. The student has to implement and present the project as per the given schedule. During the implementation of the project, Personnel Software Process (PSP) has to be followed. Report of the project work has to be submitted for evaluation.

Schedule

S.No	Description	Duration
1.	Problem Identification / Selection	2 weeks
2.	Preparation of Abstract	1 week
3.	Design, Implementation & Testing of the Project	7 weeks
4.	Documentation & Project Presentation	4 weeks

Guidelines for the Award of marks

S.No.	Description	Max. Marks
1.	Weekly Assesment	20
2.	PPT Preparation	05
3.	Presentation	10
4.	Question and Answers	05
5.	Report Preparation	10

Final Mini Project demonstration and PPT presentation is to be evaluated for the entire class together by all the faculty handling MiniProject for that class.

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18IT C15 **OPERATING SYSTEMS**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To familiarize students with various services provided by an operating system.
2. To introduce the concepts of process, process synchronization and process scheduling.
3. To deal with different approaches of memory management.
4. To facilitate understanding of the structure and organization of the file system.
5. To provide understanding of Protection and security aspects of operating systems.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Demonstrate operating system services, inter process communication and multithreaded Programming.
2. Apply suitable process scheduling, deadlocks handling algorithms and solve process-synchronization.
3. Make use of advanced techniques such as paging, segmentation and virtual memory for memory management.
4. Illustrate file system interfaces and its implementation.
5. Identify the Operating System Security problems and Threats

UNIT–I

Introduction: Definition of Operating System, Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Computing Environments, Open-Source Operating Systems.

Operating System Structures: Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure, System Boot.

Process: Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication

Threads: Overview, Multicore Programming, Multithreading Models, Threading Issues.

UNIT–II

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling.

Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors.

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT–III

Memory Management Straegies: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.

Virtual Memory Management: Background, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory.

UNIT–IV

File-System: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing Protection.

Implementing File Systems: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance.

Mass-Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management.

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UNIT–V

System Protection: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Implementation of the Access Matrix, Access Control, Revocation of Access Rights, Capability-Based Systems

System Security: The Security Problem, Program Threats, System and Network Threats, Cryptography as a Security Tool, User Authentication.

Text Book:

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Pvt Ltd, 2016.

Suggested Reading:

1. A.Tanenbaum, "Modern Operation Systems", 3rd Edition, Pearson Education, 2008.
2. William Stallings, "Operating Systems", 5th Edition, Pearson Education, 2005.
3. Ida M.Flynn, "Understanding Operating Systems", 6th Edition, Cengage, 2011.
4. D.M.Dhamdhere,"Operating systems a concept based approach", 2nd Edition, McGraw-Hill, 2007.

Web Resources:

1. http://nptel.ac.in/downloads/106108101/
2. http://www2.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/
3. http://www.cs.kent.edu/~farrell/osf03/oldnotes/

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18IT C16 **THEORY OF AUTOMATA**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To study abstract computing models namely Finite Automata, Pushdown Automata, and Turning Machines.
2. To introduce various grammars, formal languages and their relationships.
3. To impart the relation between various grammars and recognizers for different formal languages.
4. To aquiant with mathematical methods to prove properties of languages, grammars and automata.
5. To familiarize with decidability and undecidability of computational problems.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Build Deterministic, Non deterministic Finite automata for Languages and show the acceptance of strings using Formal Machines.
2. Develop regular expressions and their equivalent finite automata for different languages.
3. Infer Context-free grammars for certain languages and Test for Closure Properties and Decision Properties of CFL's.
4. Construct pushdown automata for languages and Analyze Equivalence of PDA's, CFG's.
5. Identify Recursively Enumerable Languages, Undecidable problems using Turing Machines and Model Turing Machines for simple Computational Problems.

UNIT-I

Automata: Introduction to Finite Automata, the Central Concepts of Automata Theory: Alphabets, Strings and Languages.

Finite Automata: An Informal Picture Of Finite Automata: The Ground Rules, the Protocol, Enabling the Automata to Ignore Actions, the Entire System as an Automaton. Deterministic Finite Automata: Definition of a DFA, Simpler Notations for DFA's, Extending the Transition Function to Strings, The Language of a DFA, Nondeterministic Finite Automata: Definition of NFA, The Extended Transition Function, The Language of an NFA, Equivalence of NFA and DFA, An Application: Text Search, Finite Automata with Epsilon-Transitions: Use of €-transitions, The formal notation for an €- NFA, €-closure, Extended Transitions and Languages for €-NFA's, Eliminating €-transitions.

UNIT-II

Regular Expression and languages: Regular Expressions: The Operators of Regular Expressions, Building Regular Expressions. Finite Automata and Regular Expression: From DFAs to Regular Expressions, Converting DFA's to Regular Expressions by Eliminating States, Converting Regular Expressions to Automata, Applications of Regular Expressions, Algebraic Laws for Regular Expressions.

Properties of Regular Languages: Proving Languages not to be Regular: The pumping lemma for Regular Languages, Applications of Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages: Testing Emptiness of Regular Languages, Testing Membership in a Regular Language. Equivalence and Minimization of Automata: Testing Equivalence of States, Testing Equivalence of Regular Languages, Minimization of DFA's.

UNIT-III

Context Free Grammars and Languages: Context-Free Grammars: Definition of Context Free Grammars, Derivations using a Grammar, Leftmost and Rightmost Derivation, The language of a Grammar, Parse Trees: Constructing Parse Trees, The Yield of a Parse Tree, Applications of CFGs, Ambiguity in Grammars and Languages: Ambiguous Grammars, Removing Ambiguity From Grammars, Leftmost Derivations as way to Express Ambiguity, Inherent Ambiguity.

Properties of Context Free Languages: Normal Forms for Context-Free Grammars: Eliminating Useless Symbols, Computing the Generating and Reachable Symbols, Eliminating Productions, Eliminating Unit

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Productions, Chomsky Normal Form, Pumping Lemma for CFL's: Statement of the Pumping Lemma, Applications of Pumping Lemma for CFL's, Closure Properties of CFL's, Decision Properties of CFL's: Testing Emptiness of CFL's, Testing Membership in a CFL's.

UNIT-IV

Pushdown Automata: Definition of pushdown automaton: The Formal Definition of PDA, Graphical Notation for PDA's, Instantaneous Description of a PDA, The Language of a PDA: Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final State, From Final State to Empty Stack, Equivalence of PDA's and CFG's: From Grammars to PDA's, From PDA's to Grammars, Deterministic Pushdown Automata: Definition, Regular Languages and Deterministic PDA's.

UNIT-V

Introduction to Turing Machines: Problems that Computer Cannot Solve: The Turing Machine: Notation for the TM, Instantaneous Descriptions for TM's, Transitions Diagrams, The Language of a TM, Turing Machines and Halting, Programming Techniques for Turing Machines: Storage in the State, Multiple Tracks, Subroutines. Extensions to the Basic Turing machine, Restricted Turing machines, Turing Machine and Computers: Simulating a Computer by a TM.

Undecidability: A Language That Is Not Recursively Enumerable: Enumerating the Binary Strings, Codes for Turing Machines, The Diagonalization Language, An Undecidable problem that is RE: Recursive Languages, Compliments of Recursive and RE languages, The Universal Languages, Undecidablity of the Universal Language, Undecidable problems about Turing Machines: Reductions, TM's That Accept The Empty Language, Rice's Theorem and Properties of RE languages, Post's Correspondence Problem: Definition of PCP, The Modified PCP, Other Undecidable Problems.

Text Book:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D Ullman, "Introduction to Automata Theory Languages and Computation", 3rd Edition, Pearson Education, 2007.

Suggested Reading:

1. John C Martin. "Introduction to Language and Theory of Computation", 3rd Edition, TMH, 2003.
2. Daniel Cohen, "Introduction to Computer Theory", 2nd Edition, Wiley Publications, 2007.
3. Mishra K., Chandrasekaran N., "Theory of Computer Science (Automata, Languages and Computation)", 3rd Edition, Prentice Hall of India 2008.
4. ShyamalendraKandar, "Introduction to Automata Theory, Formal Languages and Computation", Pearson, 2013.

Web Resources:

1. http://nptel.ac.in/courses/106106049/
2. http://online.stanford.edu/course/automata-theory

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18IT C17 **COMPUTER NETWORKS**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To present an overview of computer networking concepts and give an insight into the working principles of popular Internet Applications WWW, HTTP, Electronic Mail and Domain Name System.
2. To facilitate state-of-the-art knowledge on Network Layer issues including Routing and Addressing.
3. To introduce IP based transport protocols TCP and UDP.
4. To familiarize an understanding of various data link control protocols.
5. To provide main issues related to network security and relevant cryptographic techniques.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Describe the components, reference models, services and performance measures of Computer Networks and operating principles of WWW, HTTP, FTP, Electronic Mail and Domain Name System.
2. Identify transport layer services and infer UDP and TCP protocols.
3. Propose appropriate routing algorithm for Data routing.
4. Illustrate data link layer protocols for error detection, correction, channel partitioning and addressing.
5. Summarize various network security threats and cryptographic algorithms.

UNIT-I

Computer Networks and the Internet: Internet-A Nuts-and-Bolts Description, A Services Description, Protocol, The Network Edge - Access Networks, Physical Media, The Network Core, Packet Switching, Circuit Switching, A Network of Networks, Delay, Loss, and Throughput in Packet-Switched Networks- Overview of Delay in Packet-Switched Networks, Queuing Delay and Packet Loss, End-to-End Delay, Throughput in Computer Networks, Protocol Layers and Their Service Models-Layered Architecture, Encapsulation

Application Layer: Principles of Network Applications- Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols, The Web and HTTP - Overview of HTTP, Non-Persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer- FTP- SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols Electronic Mail in the Internet DNS The Internet's Directory Service -Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages

UNIT-II

Transport Layer- Introduction and Transport-Layer Services- Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP-UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer- Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N (GBN), Selective Repeat (SR), Connection-Oriented Transport: TCP- The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control- The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-Assisted Congestion-Control Example: ATM ABR Congestion Control

UNIT-III

Network Layer: Introduction- Forwarding and Routing Network Service Models Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Inside a Router- Input Processing, Switching, Output Processing, Queuing, The Internet Protocol (IP)-Forwarding and Addressing in the Internet, Datagram Format, IPv4 Addressing, Internet Control Message Protocol (ICMP), IPv6, Routing Algorithms, The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet- Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP, Broadcast and Multicast Routing- Broadcast Routing Algorithms, Multicast

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UNIT-IV

The Link Layer: Links, Access Networks, and LANs, Introduction to the Link Layer - The Services Provided by the Link Layer, Link Layer Implementation Error-Detection and -Correction Techniques- Parity Checks, Checksumming Methods, Cyclic Redundancy Check (CRC), Multiple Access Links and Protocols- Channel Partitioning Protocols, Random Access Protocols Taking-Turns Protocols, Switched Local Area Networks, Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs), Data Center Networking

UNIT-V

Security in Computer Networks: Network Security, Principles of Cryptography-Symmetric Key Cryptography, Public Key Encryption, Message Integrity and Digital Signatures-Cryptographic Hash Functions, Message Authentication Code, Digital Signatures, End-Point Authentication-Authentication Protocols, Securing E-Mail- Secure E-Mail, PGP, Network-Layer Security- IPsec and Virtual Private Networks (VPNs)

Text Book:

1. James F. Kurose, Keith W. Ross, “Computer Networking – A Top-Down Approach Featuring the Internet”, 6th Edition, Pearson Education, 2013.

Suggested Reading:

1. Andrew S. Tanenbaum and David J. Wetherall, “Computer Networks”, 5th Edition, Prentice Hall, 2013.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan Kaufmann Publishers, 2011.
3. Behrouz A. Forouzan, “Data communication and Networking”, 4th Edition, Tata McGraw – Hill, 2011.
4. Nader. F. Mir, “Computer and Communication Networks”, Pearson Prentice Hall Publishers, 2010.

Web Resources:

1. https://nptel.ac.in/courses/106105081/
2. http://www.redbooks.ibm.com/abstracts/gg243376.html
3. http://www.ietf.org/rfc.html

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18IT C18 **SOFTWARE ENGINEERING**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To describe various software life cycle models and Agile software development concepts.
2. To introduce the Behavioural modeling concepts in UML.
3. To define the structural modeling concepts in UML.
4. To familiarize with Software Testing Techniques and tools.
5. To capacitate the students with Risk management and Product metrics concepts.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Describe the concepts of Software Engineering and build the Requirements model.
2. Develop basic and advanced behavioral models using the concepts of Unified Modelling Language.
3. Design various structural models such as Class, Objects and Packages for real world scenarios.
4. Acquire thorough knowledge of software testing strategies and testing tools.
5. Estimate the software productivity using product metrics and acquire knowledge of software risk Management.

UNIT-I
Software and Software Engineering: The Nature of Software, Software Engineering. The Software Process, Software Engineering Practice. **A Generic view of Process :** Software Engineering -A Layered Technology, A Process frame work, Process Models-Waterfall model, spiral model , The Unified Process, Product and Process, Process Assessment and Improvement, The CMMI, Introduction to Agile development-Extreme programming.
Understanding Requirements: Requirements Engineering, Establishing the Groundwork,Eliciting Requirements, Building the Requirements Model, Negotiating Requirements, Validating Requirements. **Requirements Modeling:** Requirements Analysis, Scenario-Based Modeling, Problem Analysis, Software Requirement and specifications.

UNIT-II
UML Introduction: Model, Introducing the UML, Elements of UML-Things Relationships and Diagrams.
Basic Behavioral Modeling: Interactions, Use Cases, Use Case Diagrams, Interaction diagrams-Sequence diagrams-components of Sequence diagrams, Collaboration diagrams-Components of Collaboration diagrams, Activity diagrams-components of activity diagrams, Swimlane diagrams, Case studies on Use Case diagrams, Interaction diagrams.

UNIT-III
Basic Structural Modeling: Classes, Relationships, Class Diagrams, Advanced Structural Modeling: Advanced Classes, Advanced Relationships, Interfaces, Components, Collaborations and Deployment diagrams, Case studies on class diagrams.
Quality Concepts: Software Quality, Achieving Software Quality, Software Quality Assurance: Background Issues, Elements of Software Quality Assurance, SQA Tasks, The ISO 9000 Quality Standards.

UNIT-IV
Software Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Validation Testing, System Testing. Testing Tools–Rational functional tester, Selenium software testing tool.
Testing Conventional Applications: Software Testing Fundamentals, White-Box Testing, Basis Path Testing, Black–Box Testing, Alpha testing, Beta testing.

UNIT-V
Product Metrics: A Framework for Product Metrics, Size Metrics like LOC, Function points.
Risk Management: Software Risks, Reactive versus Proactive Risk Strategies, Risk Mitigation, Monitoring, and Management, The RMMM Plan.

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Text Books:

1. Roger S.Pressman, “Software Engineering: A Practitioners Approach”, 7^{th} Edition, McGraw Hill, 2017.
2. Grady Booch, James Rumbaugh, Ivor Jacobson, “The Unified Modeling Language-User Guide (Covering UML 2.0)”, 3^{rd} Edition, Pearson Education, India, 2010.
3. Pankaj Jalote “An Integrated Approach to Software Engineering”, 3^{rd} Edition, Narosa Publishing house, 2008.

Suggested Reading:

1. Martin Fowler, Kendall Scott “UML Distilled**:** A Brief Guide to the Standard Object Modeling Language” Addison Wesley, 4^{th} Edition, 2011.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, “Fundamentals of Software Engineering”, PHI, 2^{nd} Edition.

Web Resources:

1. http://tuvalu.cs.flinders.edu.au/seweb/se-ed/
2. IBM Rational http://www-306.ibm.com/software/rational/uml/
3. http://www.togethersoft.com/services/practical_guides/umlonlinecourse/

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18IT E01 **DATA WAREHOUSING AND DATA MINING**

(Core Elective–1)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce the concepts of Data Warehouse and Data Mining.
2. To familiarize different kinds of data and various preprocessing techniques.
3. To present different frequent pattern discovery methods.
4. To describe various classification and clustering techniques.
5. To facilitate the learning of outlier analysis.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the basic requirements of data mining and apply pre-process techniques.
2. Build Multidimensional data model and perform OLAP operations, generate Association rules from data.
3. Build and evaluate models for Classification and Prediction.
4. Evaluate the advanced classification and clustering techniques.
5. Understand outlier detection and real time applications of Data mining.

UNIT-I

Introduction: Data mining, Kinds of data, Kinds of pattern, Major issues in data mining. **Getting to know your data:** Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity. **Data Preprocessing:** An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT-II

Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage: A Business Analysis Framework for Data Warehouse Design, Data Warehouse Design Process, Data Warehouse Usage for Information Processing, Data Warehouse Implementation. **Mining Frequent Patterns, Associations and correlations:** Basic Concepts, Frequent Item Set Mining Methods, Interesting patterns, Pattern Evaluation Methods. Advanced Pattern Mining: Pattern Mining in Multilevel and Multidimensional Space.

UNIT-III

Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Introducing Ensemble Methods, Bagging, Boosting, Random Forests, Improving Classification Accuracy of Class-Imbalanced Data.

UNIT-IV

Classification: Advanced Methods: Bayesian Belief Networks, Classification by Back propagation, Support Vector Machines, Lazy Learners (or Learning from Your Neighbors), Other Classification Methods.
Cluster Analysis: Basic Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, DBSCAN, Evaluation of Clustering, Clustering graph and network data.

UNIT-V

Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches **Data Mining Trends and Research Frontiers:** Mining Complex Data Types: Mining Sequence Data: Mining Other Kinds of Data, Data Mining Applications, Data Mining and Society, Data Mining Trends.

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Text Book:

1. Han J, Kamber M, Jian P "Data Mining: Concepts and Techniques", 3rd Edition, Elsevier, 2012.

Suggested Reading:

1. Pang-Ning Tan, Michael Steinback, Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2008.
2. M. Humphires, M.Hawkins, M.Dy,"Data Warehousing: Architecture and Implementation", Pearson Education, 2009.
3. Anahory, Murray, "Data Warehousing in the Real World", Pearson Education, 2008.
4. Kargupta, Joshi, etc., "Data Mining: Next Generation Challenges and Future Directions", Prentice Hall of India Pvt. Ltd, 2007.

Web Resources:

1. https://hanj.cs.illinois.edu/bk3/
2. https://www.kdnuggets.com/
3. http://archive.ics.uci.edu/ml/index.php

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With effect from Academic Year 2020-21

18IT E04 **UNIX AND SHELL PROGRAMMING**

(Core Elective-1)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To familiarize students with the UNIX environment and basic UNIX utilities.
2. To introduce File systems and File structures.
3. To impart skills required for shell scripting and process handling.
4. To develop skills required to formulate regular expressions.
5. To familiarize students with the routine system administrative features and tools.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Describe the functional architecture, features and utilities of UNIX OS
2. Demonstrate various File handling operations
3. Understand the basic of the shell scripting and process handling mechanism using commands
4. Build regular expressions for pattern matching to design a task specific filter
5. Write application specific shell program and perform system administration

UNIT-I

Introduction to Unix: The UNIX Operating System, The UNIX Architecture, Features of UNIX, Internal and External Commands, Command Structure, **General-Purpose Utilities:**cal, date, echo, printf, bc, script, mailx, passwd, who, uname, tty, sty. **The vi editor:** vi Basics, Input Mode, Saving Text and Quitting, Navigation, Editing Text, Undoing Last Editing Instructions, Repeating the Last Command, Searching for a Pattern, Substitution.

UNIT-II

Handling Files: The File System, Parent Child Relationship, The HOME variable, pwd,cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames, The UNIX File System cat, cp, rm, mv, more, file, ls, wc, cmp, comm, diff. **Compressing and Archiving files:**gzip and gunzip- Compressing and Decompressing files, tar-The Archival program, zip and unzip- Compressing and Archiving together.

File Attributes: ls options -l, -d,-lh,-la, File Ownership, File Permissions, chmod-Changing File permissions, Directory Permissions, Changing File ownership.

UNIT-III

The Shell: The Shells's interpretive Cycle, Shell Offerings, Pattern Matching, Escaping and quoting, Redirection, /dev/null and /dev/tty, Pipes, tee- Creating a tee, Command Substitution, Shell Variables.

The Process: Process Basics, ps- Process Status, System Processes (-e or –a), Mechanism of Process creation, Internal and External Commands, Process states and Zombies, Running jobs in Background, nice-Job Execution with low priority, Killing Processes with signals, Job Control, at and batch-Execute later, cron- Running jobs periodically, time-Timing Processes.

UNIT-IV

Simple Filters: pr-Paginating Files, head- Displaying the beginning of a File, tail-Displaying the end of a File, cut- Slitting a File vertically, paste-Pasting Files, sort-Ordering a File, uniq- Locate Repeated and Non-repeated Lines, tr- Translating Characters.

Filters using Regular Expressions: grep, Basic Regular Expressions, Extended Regular expressions, egrep, sed, Line Addressing, Using multiple instructions, Context Addressing, Writing Selected lines to a File, Text Editing, Substitution.

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UNIT-V

Shell Programming: Shell scripts, read, Using Command Line Arguments, exit, The logical operators && and ||, Conditional execution- if, Using test and [ ] to evaluate expressions, case, expr, while, for, set and shift, trap, Debugging shell scripts with set–x.

System Administration: root, The administrator's privileges, Maintaining Security, User Management, Startup and Shutdown, Managing Disk Space, Device Files.

Text Book:

1. Sumitabha Das, "Unix Concepts and Applications", 4th Edition, TMH, 2006.

Suggested Reading:

1. Behrouz A. Forouzan, Richard F. Gilbery, "Unix and Shell Programming", 1st Edition, Cengage Learning India, 2003.
2. Graham Glass, King Ables, "Unix for programmers and users", 3rd Edition, Pearson Education, 2009.
3. YashwanthKanitkar, "Unix Shell programming", 1st Edition, BPB Publishers, 2010.
4. M.G. Venkateshmurthy, "Introduction to Unix and Shell Programming", Pearson Education, 2005.

Web Resources:

1. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=PracticalUnix
2. https://www.shellscript.sh/
3. www.bash.academy/
4. http://linuxcommand.org/

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18IT E05 **PREDICTIVE ANALYTICS WITH 'R'**

(Core Elective-2)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce Predictive Modeling.
2. To familiarize Regression and Classification Techniques.
3. To impart knowledge on the concepts of Neural Networks and various model Evaluation Techniques.
4. To introduce Topic Modeling.
5. To explore various case studies.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Perform predictive modelling and evaluate the performance
2. Understand regression techniques and Support Vector Machines
3. Evaluate different classifiers and build an efficient networking model
4. Analyze various ensemble methods, probabilistic Graphic models and understand topic modeling
5. Analyze time series models on real world data

Gearing Up for Predictive Modeling: Models**, Types of models :** Supervised, unsupervised, semi-supervised, and reinforcement learning models, Parametric and nonparametric models, Regression and classification models, Real-time and batch machine learning models, **The process of Predictive Modeling:** Defining the model's objective, Collecting the data, Picking a model, Preprocessing the data, Exploratory data analysis, Feature transformations, Encoding categorical features, Missing data, Outliers, Removing problematic features, Feature engineering and dimensionality reduction, Training and assessing the model, Repeating with different models and final model selection, Deploying the model, **Performance metrics:** Assessing regression models, Assessing classification models, Assessing binary classification models.

UNIT-II

Linear Regression: Introduction to linear regression, Simple linear regression, Multiple linear regression, Assessing linear regression models, Problems with linear regression, Feature selection, Regularization, Ridge regression**.**

Logistic Regression: Classifying with linear regression, Assessing logistic regression models, Regularization with the lasso, Classification metrics, Extensions of the binary and Multinomial logistic classifier **Support Vector Machines:** Maximal margin classification, Support vector classification, Inner products**,** Kernels and support vector machines, Cross-validation.

UNIT-III

Neural Networks: Stochastic gradient descent**:** Gradient descent and local minima, The perceptron algorithm, Linear separation, The logistic neuron, **Multilayer perceptron networks:** Training multilayer perceptron networks.

Tree-based Methods: The intuition for tree models, Algorithms for training decision trees- Classification and regression trees, CART regression trees, Tree pruning, Missing data, Regression model trees CART classification trees, C5.0, Predicting complex skill learning, Variable importance in tree models,

UNIT-IV

Ensemble Methods: Bagging - Margins and out-of-bag observations, Predicting heart disease with bagging, Limitations of bagging, **Boosting –** AdaBoost, Limitations of boosting, **Random forests-** The importance of variables in random forests,

Probabilistic Graphical Models: A little graph theory, Bayes' Theorem, Conditional independence, Bayesian networks, The Naïve Bayes classifier. Hidden Markov models- Predicting letter patterns in English words.

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Topic Modeling: An overview of topic modeling, Latent Dirichlet Allocation, The Dirichlet distribution, The generative process, Fitting an LDA model, Modeling the topics of online news stories, Model stability, Finding the number of topics, Topic distributions, Word distributions, LDA extensions

UNIT-V

Time Series Analysis: Fundamental concepts of time series, Time series summary functions, Some fundamental time series - White noise, Fitting a white noise time series, Random walk - Fitting a random walk, **Stationarity:** Stationary time series models, Moving average models, Autoregressive models - Autoregressive moving average models, **Non-stationary time series models:** Autoregressive integrated moving average models, Autoregressive conditional heteroscedasticity models, Generalized autoregressive heteroscedasticity models. Predicting foreign exchange rates, Other time series models. **Recommendation Systems:** Rating matrix, Measuring user similarity, Collaborative filtering, User-based collaborative filtering, Item-based collaborative filtering, Singular value decomposition, Other approaches to recommendation.

Text Books:

1. Rui Miguel Forte, “Mastering Predictive Analytics with R”, Packt Publishing Ltd, 2015.
2. Roger D. Peng,“R Programming for Data Science”, Lean Publishing, 2015.

Suggested Reading:

1. Lantz Brett, “Machine Learning with R”, 2nd Edition, Packt Publishing Limited.
2. Sunila Gollapudi, “Practical Machine Learning”, Packt Publishing Ltd.
3. Ethem Alpaydin, “Introduction to Machine Learning”, 2nd Edition, PHI, 2013.

Web Resources:

1. https://data-flair.training/blogs/r-predictive-and-descriptive-analytics/
2. https://www.littlemissdata.com/blog/predictive-analytics-tutorial-part-1
3. http://uc-r.github.io/mars

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18IT C19 **OPERATING SYSTEMS AND COMPUTER NETWORKS LAB**

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To familiarize with various system calls of LINUX and network commands.
2. To introduce Inter process communication Methods and CPU scheduling algorithms.
3. To facilitate knowledge required to handle deadlocks and use semaphores.
4. To presenr Client/Server applications based on TCP and UDP using Java Socket API.
5. To provide knowledge required to implement error detection, network routing algorithms and encryption algorithms.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Demonstrate starting of a new process, replacing a process and execute basic System Calls.
2. Implement Inter-process communication and CPU scheduling Algorithms.
3. Apply the appropriate method to handle deadlocks and synchronize processes to solve critical section problems.
4. Show client-server communication using TCP and UDP.
5. Examine Error detection using CRC, encryption and routing algorithms.

List of Programs

Operating System Programs:

1. a) Demonstrate the system calls. a) fork b) execvp c) stat d) setenv & getenv
   b) Basic networking Commands: - ping, tracert, netstat, ipconfig, traceroute
2. Implement Inter process communication between a server and multiple clients
3. Implement CPU scheduling algorithms
4. Implement Banker's algorithm for Deadlock Avoidance.
5. Implement Producer-Consumer Problem using semaphores.

Computer Network Programs:

6. Implementation of TCP (Server and client) and UDP (Server and client)
7. Capture and analyze IP packets by executing trace route.
8. Implement Dijkstra's and Distance Vector routing algorithms
9. Implement CRC Error detection technique.
10. Implement RSA asymmetric Encryption Algorithm.

Text Books:

1. W. Richard Stevens, "Unix Network Programming", Volume 2, 2nd Edition, Pearson Education, 2015.
2. James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, 2013.

Suggested Reading:

1. A.Tanenbaum, "Modern Operation Systems", 3rd Edition, Pearson Education, 2008.
2. Silberschatz, Galvin, and Gagne," Operating System Concepts", 8th Edition,Wiley Publication.
3. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 5th Edition, Prentice Hall, 2013.

Web Resources:

1. https://www.cse.iitb.ac.in/~mythili/teaching/cs347_autumn2016/index.html
2. https://www.nsnam.org/docs/tutorial/html/

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18IT C20 **SOFTWARE ENGINEERING LAB**

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To discuss use case models that capture requirements of a software system.
2. To illustrate dynamic models of a software system.
3. To build class diagrams that models a software system.
4. To acquaint with activity and swimlane models.
5. To familiarize with analysis and design models.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Interpret user requirements using the UML notation.
2. Illustrate Dynamic models of a software system.
3. Design class diagrams that model a software system.
4. Develop Activity and swim lane models.
5. Implement Analysis and Design models for various real world scenarios.

List of Experiments

1. Construct Use case diagrams for the following
   a. Diagram editor.
   b. Library information system.
   c. Banking system.
2. Construct Sequence diagrams for the following.
   a. Mobile phone.
   b. Use case student register for a course.
   c. Diagram editor.
3. Construct Collaboration diagrams for the following
   a. Use case librarian issues books to student.
   b. Mobile phone.
   c. Diagram editor.
4. Construct Activity diagrams for the following
   a. ATM transaction.
   b. Ticket machine.
   c. Sales order processing.
5. Construct Swim lane diagrams for the following
   a. Account.
   b. CD player.
   c. ATM machine.

Case Studies:

Develop analysis and design models for

6. Passport automation system
7. Credit card processing
8. BPO management system
9. E-book management system
10. Recruitment system

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Text Books:

1. G. Booch, J. Rumbaugh, and I. Jacobson, “The Unified Modeling Language User Guide”, Addison-Wesley, 1st Edition, 1998. (Chapters 17 to 27).
2. Grady Booch, RobertA.Maksimchuk, “Object - Oriented Analysis and Design with Applications”, Addision-Wesley, 3rd Edition, 2007. (Chapters 8 to 12).

Suggested Reading:

1. Martin Fowler, Kendall Scott, “UML Distilled**:** A Brief Guide to the Standard Object Modeling Language” Addison Wesley, 4th Edition, 2011.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, “Fundamentals of Software Engineering”, PHI, 2nd Edition.

Web Resources:

1. SEweb - Software Engineering Education Home Page: http://tuvalu.cs.flinders.edu.au/seweb/se-ed/
2. IBM Rational http://www-306.ibm.com/software/rational/uml/
3. Practical UML - A Hands-On Introduction for Developers
   http://www.togethersoft.com/services/practical_guides/umlonlinecourse

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18IT C21 **MINI PROJECT – III**

Instruction	2 Hours per week
Duration of Semester End Examination	-
Semester End Examination	-
CIE	50 Marks
Credits	1

Course Objectives:
1. To enable students to learn by doing.
2. To develop capability to analyse and solve real world problems.
3. To develop innovative ideas among the students

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Interpret Literature with the purpose of Formulating a project proposal.
2. Planning, analyzing, Designing and implement a software project using SDLC model.
3. Find the solution of identified problem with the help of modern Technology and give priority to real time scenarios.
4. Plan to work as a team and to focus on getting a working project done and submit a report with in a stipulated period of time.
5. Final Seminar, as oral Presentation before departmental Committee.

The Students are required to implement a project from opted subject in the core elective-2. During the implementation of the project, Personnel Software Process (PSP) has to be followed.

Report of the project work is to be submitted at the end of the Semester for evaluation.

Schedule

S.No	Programming concepts are to be taught related to the courses choosen from core elective – 2	4 weeks
1.	Problem Identification / Selection	2 weeks
2.	Preparation of Abstract	1 week
3.	Design, Implementation & Testing of the Project	5 weeks
4.	Documentation & Project Presentation	2 weeks

Guidelines for the Award of marks

S.No.	Description	Max. Marks
1.	Weekly Assesment	20
2.	PPT Preparation	05
3.	Presentation	10
4.	Question and Answers	05
5.	Report Preparation	10

Final Mini Project demonstration and PPT presentation is to be evaluated for the entire class together by all the faculty handling Mini Project for that class.

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18IT C22 **ARTIFICIAL INTELLIGENCE**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Learn problem solving through search techniques.
2. Familiarize with knowledge representation and logical reasoning techniques in AI.
3. Learn probabilistic reasoning models on uncertain data.
4. Acquaint with supervised and reinforcement learning.
5. Learn syntax and semantic analysis of the natural language.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the basics of AI and analyze various Exhaustive and Heuristic Search Techniques.
2. Apply logical concepts and representation techniques to infer knowledge.
3. Understand quantification of uncertainty and evaluate data using probabilistic reasoning models.
4. Apply the techniques of supervised and reinforcement learning on data.
5. Process Natural Language and perform syntax & semantic analysis.

UNIT-I

Introduction: The Foundations of AI, History of AI. Intelligent agents – Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.
Solving problems by searching: Problem Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed Search Strategies, Heuristic Functions.
Adversarial search: Games, Optimal decisions in games, Alpha-Beta Pruning. Constraint Satisfaction Problems- Defining constraint satisfaction Problems.

UNIT-II

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming.
Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT-III

Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and its Use.
Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Exact Inference in Bayesian Networks. **Probabilistic Reasoning over Time:** Time and Uncertainty, Inference in Temporal Models, Hidden Markov Models, Kalman Filters.

UNIT-IV

Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks, Nonparametric Models, Support Vector Machines.
Learning Probabilistic Models: Statistical Learning, Learning with Complete Data.
Learning with Hidden Variables: The EM Algorithm
Reinforcement Learning: Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning-Q learning.

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UNIT–V

Natural Language Processing: Language Models, Text Classification, Information Retrieval, Information Extraction.

Natural Language for Communication: Phrase Structure Grammars, Syntactic Analysis, Augmented Grammars and Semantic Interpretation.

Text Books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach" , Prentice Hall, 3^{rd} Edition.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.

Suggested Reading:

1. Nilsson, N., “Artificial Intelligence: A New Synthesis”, San Francisco, Morgan Kaufmann, 1998.
2. Rich, Knight, Nair: “Artificial intelligence”, Tata McGraw Hill, Third Edition, 2009.
3. Tom M. Mitchell, “Machine Learning”, McGraw Hill, 1997.
4. Kulkarni, Parag, Joshi, Prachi ,”Artificial Intelligence : Building Intelligent Systems”, PHI, 2015.
5. Peter Jackson, “Introduction to Expert Systems”, Third Edition, Pearson Addison Wesley, 1998.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs19/
2. https://www.coursera.org/learn/ai-for-everyone

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18IT C23 **INFORMATION SECURITY**

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	20 Marks
Credits	2

Course Objectives:

1. To provide basic concepts of Information security and threats its associated attacks.
2. To explore the role of risk management and security technology like firewalls and Intrusion systems.
3. To familiarize with the concepts Cryptographic algorithms and Transport level Security.
4. To acquire knowledge of Electronic mail,IP Security and User Authentication.
5. To introduce how security policy affects the ongoing technical and administrative evaluation.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Describe the components of information security and identify threats, attacks that cause harm to organizational assets.
2. Examine the control measures to maintain the level of risk and make use of firewalls and intrusion detection systems to protect the networks.
3. Demonstrate cryptographic algorithms and implement secure communications between web browser and a web server.
4. Inspect on three functional areas like authentication, confidentiality and key management.
5. Compare information security technical and non-technical aspects and aware of employment policies and practices.

UNIT-I

Introduction to Information Security: History of Information Security, What Is Security, CNSS security model, Components of an Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, Security in the Systems Life Cycle, Security Professionals and the Organization.

Need for Security: Business needs, Threats and Attacks, Compromises to Intellectual Property, Deviations in Quality of Service, Espionage or Trespass, Forces of Nature, Human Error or Failure, Information Extortion, Sabotage or Vandalism, Software Attacks, Technical Hardware Failure or Errors, Technical Software Failure or Errors, Technological Obsolescence, Theft.

UNIT-II

Risk management: An Overview of Risk Management, Risk Identification, Risk assessment, Risk Control, Quantatitive versus Qualitative Risk Management Practices, Recommended Risk Control Practices.

Security Technology: Introduction,Access Control, Firewalls, Intrusion detection and prevention systems, Honeypots,Honeynets, Padded Cell Systems, Scanning and Analysis Tools.

UNIT-III

Cryptography: Introduction, Foundations of Cryptology, Cipher methods, cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications.

Transport Level Security: Web Security Considerations, Secure Socket Layer and Transport Layer Security, HTTTPS, Secure Shell.

UNIT-IV

Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail.

IPSecurity: IPSecurity Overview, IPSecurity Policy, Encapsulating Security Payload, Combining Security Associations, Internet key exchange.

User Authentication: kerberos, Federated Identity Management.

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UNIT-V

Implementing Information Security: Introduction, Information Security Project Management, Technical Aspects of Implementation, Non technical Aspects of Implementation, Information Systems Security Certification and Accreditation.

Security and Personnel: Introduction ,Positioning and Staffing Security Function, Employment Policies and Practices, Security Considerations for Temporary Employees, Consultants and Other Workers, Internal Control Strategies, Privacy and the Security of Personnel Data.

Information security Maintenance: Introduction, Security Management Maintenance Models, Digital Forensics.

Text Books:

1. Michael E. Whitman, Hebert J Mattord, “Principles of Information Security”, 5^{th} Edition, Cengage Learning, 2014.
2. Thomas R Peltier, Justing Peltier, JohnBlackley, “Information Security Fundamentals”, Auerbacj Publications, 2010.
3. William Stallings “Cryptography and Network Security Principles and Practice”, 6^{th} Edition, Pearson, 2014.

Suggested Reading:

1. Dr.V.K.Jain,”Cryptography and Network Security”, 1^{st} Edition, Khanna Book publishing, 2013.
2. Marks Merkow, Jim Breithaupt, “Information Security: Principle and Practices”, 2^{nd} Edition, Pearson Education, 2014.

Web Resources:

1. https://www.sans.org/security-resources/
2. https://nptel.ac.in/courses/106106129/

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18IT E09

SOCIAL MEDIA ANALYTICS

(Core Elective - 3)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce Social Media Mining, Graph Essentials and Network Models.
2. To familiarize various algorithms for the study of Communities.
3. Impart knowledge about Mining, Influence and Homophily.
4. To familiarize Recommendation Systems and Behavioral Analytics.
5. To explore various Prediction Systems.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Describe graph essentials and various network measures and models.
2. Understand community behavior and information diffusion in social media.
3. Comprehend data mining algorithms and measure influence and homophily.
4. Understand the challenges and evaluate the recommendation systems.
5. Apply prediction algorithms for real world problems.

UNIT-I

Introduction: Social Media Mining, New Challenges for Mining.

Graph Essentials: Graph Basics, Graph Representation, Types of Graphs, Connectivity in Graphs, Special Graphs, Graph Algorithms.

Network Measures: Centrality, Transitivity and Reciprocity, Balance and Status, Similarity, Network Models: Properties of Real-World Networks, Random Graphs, Small-World Model, Preferential Attachment Model.

UNIT-II

Community Analysis: Community Detection, Community Evolution, Community Evaluation, Information. **Diffusion in Social Media:** Herd Behaviour, Information Cascades, Diffusion of Innovations, Epidemics.

UNIT-III

Data Mining Essentials: Data, Data Preprocessing, Data Mining Algorithms, Supervised Learning, Unsupervised Learning.

Influence and Homophily: Measuring Assortativity, Influence, Homophily, Distinguishing Influence and Homophily.

UNIT-IV

Recommendation in Social Media: Challenges, Classical Recommendation Algorithms, Recommendation Using Social Context, Evaluating Recommendations.

Behavior Analytics: Individual Behavior, Collective Behavior.

UNIT-V

Prediction: Predicting the future, Prediction of learning, Predicting elections, Predicting Box offices, Predicting Stock market, Closing predictions.

Text Books:

1. Zafarani R., Abbasi M.A., Liu H, "Social Media Mining: An Introduction", Cambridge University Press, 2014.
2. Lutz Finger, Soumitra Dutta, "Ask, Measure, Learn: Using Social Media Analytics to Understand and Influence Customer Behavior", O'Reilly Media, 2014.

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Suggested Reading:

1. David Easley and Jon Kleinberg, "Networks, Crowds and Markets", Cambridge University Press, 2010
2. Bing Liu, "Sentiment Analysis: mining opinions, sentiments, and emotions", Cambridge University Press, 2015.
3. Matthew A. Russell, "Mining the Social Web: Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites", O'Reilly Media 2011.

Web Resources:

1. http://www.kdd.org/kdd2015/tutorial.html
2. http://thinktostart.com/category/social-media/
3. http://blogs.iit.edu/iit_web/social-media-2/social-media-whats-your-strategy/4

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18IT E12 **MOBILE COMMERCE**
(Core Elective – 3)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To introduce fundamentals of E-Commerce.
2. To examine strategies used by businesses used to improve purchasing, logistics, and other supporting activities.
3. To impart knowledge on technical infrastructure and security needed for M-Commerce.
4. To facilitate different e-payment options.
5. To acquaint with various security issues in E-Commerce.

Course Outcomes:
After successful completion of the course, student will be able to:
1. Understand electronic commerce and the stakeholders and their capabilities and limitations in the strategic convergence of technology and business.
2. Assess e-commerce strategies and applications, including online marketing, e-government, e-learning and global e-commerce.
3. Describe the concepts of M-Commerce and its applications.
4. Categorize advantages and disadvantages of different online payment options and choose an appropriate E-commerce Solution.
5. Identify the importance of security, privacy, and ethical issues as they relate to E-Commerce.

UNIT-I
Introduction: Definition, Objectives, Advantages and disadvantages, Forces driving E-Commerce, Traditional commerce Vs. E-Commerce, E-Commerce opportunities for industries, Growth of E-Commerce. E-Commerce Models: Business to consumer, Business to Business, Consumer to Consumer, other models – Brokerage Model, Aggregator Model, Info-mediary Model, Community Model and value chain Model.

UNIT-II
Introduction: The Fundamental Functional Platform of M-Commerce – Applications - The Value Chain Supporting M-Commerce Transactions. Services and Applications in Horizontal and Vertical Markets: Personal Organizers-Location Based Services and Applications - M-Commerce Portals- Communication and Messaging-M-Commerce Data Synchronization - Education-Gaming Services.

UNIT-III
A Framework for the study of Mobile Commerce, NTT DoCoMo's I-Mode, Wireless Devices For Mobile Commerce, Towards A Classification Framework For Mobile Location Based Services, Wireless Personal And Local Area Networks, The Impact Of Technology Advances On Strategy Formulation In Mobile Communications Networks.

UNIT -IV
Electronic Payment Systems: Special features required in payment systems, Types of E-payment systems, E-Cash, E-cheque, credit card, Smart Card, Electronic Purses.
E-Marketing, E-Customer Relationship Management, E-Supply Chain Management.

UNIT-V
Security Issues in E-Commerce: Security risk of E-Commerce, Types of threats, Security tools and risk management approach, Cyber laws, Business Ethics, IT Acts.

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Text Books:

1. Ravi Kalakota & A.B. Winston, "Frontiers of Electronic Commerce", 1st Edition, Pearson Education, 2005.
2. E.BrianMennecke, J.TroyStrader, "Mobile Commerce: Technology, Theory and Applications", Idea Group Inc., IRM press, 2003.

Suggested Reading:

1. Bharat Bhaskar, "Electronic Commerce – Framework Technologies and Applications", 3rd Edition, Tata McGraw Hill, 2008.
2. Paul May, "Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business" Cambridge University Press March 2001.
3. Dr.Pandey, Saurabh Shukla, "E-commerce and Mobile commerce Technologies", Sultan chand, 2011.

Web Resources:

1. Mobile Commerce World (www.mobilecommerceworld.com) Industry news.
2. Clarke, R. (1998) Electronic Data Interchange (EDI): An Introduction. www.anu.edu.au/ people/Roger.Clarke/EC/EDIIntro.htm
3. The worldwide Mobile Marketing Association (www.mmaglobal.com) has case studies and statistics of adoption.

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18IT E13 **DATA SCIENCE WITH PYTHON**
(Core Elective – 4)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To facilitate learning fundamentals of Numpy, Pandas and various file formats.
2. To familiarise with data pre-processing operations.
3. To introduce time series data and inferential statistics.
4. To acquire knowledge about visualisation and prediction.
5. To explore various case studies.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Understand the usage of Numpy, Pandas libraries and various file formats.
2. Apply data pre-processing and visualization techniques on the data.
3. Perform time series data analysis and apply inferential statistics.
4. Visualize the data and apply prediction techniques.
5. Understand Collaborative filtering, clustering and ensemble models.

UNIT-I
NumPy Basics: Arrays and Vectorized Computation, Getting Started with pandas, Data Loading, Storage, and File Formats.

UNIT-II
Data Cleaning and Preparation, Data Wrangling: Join, Combine, and Reshape, Plotting and Visualization, Data Aggregation and Group Operations.

UNIT-III
Time Series, Advanced Pandas, Introduction to Modeling Libraries in Python, Data Analysis Examples, Inferential Statistics.

UNIT-IV
Finding a Needle in a Haystack, Making Sense of Data through Advanced Visualization, Performing Predictions with a Linear Regression, Estimating the Likelihood of Events.

UNIT-V
Generating Recommendations with Collaborative Filtering, Pushing Boundaries with Ensemble Models, Applying Segmentation with k-means Clustering, Analyzing Unstructured Data with Text Mining.

Text Books:

1. William McKinney, "Python for Data Analysis Data Wrangling with Pandas, NumPy and IPython", 2nd Edition, O'Reilly Media, 2017.
2. Samir Madhavan, "Mastering Python for Data Science", Packt Publishing, 2015.

Suggested Reading:

1. Joel Grus, "Data Science from Scratch", O'Reilly Media, 2015.
2. John V. Guttag, "Introduction to Computation and Programming Using Python– with Application to Understanding Data", The MIT Press, 2nd Edition, 2016.
3. Alberto Boschetti, Luca Massaron, "Python Data Science Essentials: A practitioner's guide covering essential data science principles, tools, and techniques", 3rd Edition, 2018.

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Web Resources:

1. https://www.analyticsvidhya.com/
2. https://www.kaggle.com
3. https://www.dataschool.io/

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Recurrent Neural Networks: Long Short-Term Memory (LSTM) Units, TensorFlow Primitives for RNN Models, Solving seq2seq Tasks with Recurrent Neural Networks, Augmenting Recurrent Networks with Attention, Dissecting a Neural Translation Network.

Text Books:

1. Simon Haykin, "Neural Networks a Comprehensive Foundation", 2nd Edition, PHI, 1999.
2. Nikhil Buduma, Nicholas Lacascio "Fundamentals of Deep Learning", 1st Edition, O'Reilly Media Inc., 2017.

Suggested Reading:

1. Li Min Fu, "Neural Networks in Computer Intelligence", TMH, 2003.
2. Yoshua Bengio, Ian Goodfellow, Aaron Courville, "Deep Learning", MIT Press, 2016.
3. C.M.Bishop, "Neural Networks and Pattern Recognition", Oxford University Press (Indian Edition), 2003.

Web Resources:

1. https://nptel.ac.in/courses/117105084/
2. http://deeplearning.net/
3. https://adeshpande3.github.io/A-Beginner%27s-Guide-To-Understanding-Convolutional-Neural-Networks/

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18IT E16 **CYBER SECURITY**
(Core Elective – 4)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To present basic concepts of Cybercrime and Cyberattacks.
2. To introduce security challenges presented by mobile devices.
3. To impart knowledge on Tools and Methods used in Cybercrime.
4. To present fundamentals concepts in Cyber Forensics.
5. To familiarize about regulatory framework for Cybersecurity.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Describe legal and global perspectives of Cybercrimes and inspect how criminals plan the attacks.
2. Identify attacks, security policies and credit card frauds in mobile and wireless computing Era.
3. Examine phishing techniques, keyloggers, spywares, password cracking methods and types of thefts used in cybercrimes.
4. Demonstrate the need for computer forensics, relevance of OSI layer model and implications for evidential aspects.
5. Evaluate the cost of cybercrimes, web threats, IPR issues, organizational guidelines for Internet usage and safe computing.

UNIT-I
Introduction to Cybercrime: Definition and origins of the word, Cybercrime and Information security, who are cybercriminals, Classification of Cybercrimes, Legal Perspectives, Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era.
Cyberoffenses: Introduction, How Criminals plan the attacks, Social Engineering, CyberStalking, Cybercafe and Cybercrimes, Botnets, Attack vector, Cloud computing.

UNIT-II
Cybercrime Mobile and Wireless Devices:Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry settings for Mobile Devices, Authentication Service Security, Attack on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations,Organizational Measures for Handling Mobile Devices-Related Security Issues, Organizational security policies and measures in Mobile Computing Era, Laptops.

UNIT-III
Tools and Methods Used in Cybercrime: Introduction, Proxy servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms,Trojan Horses and Backdoors, Steganography, DoS and DDos Attacks, SQL Injection, Buffer Overflow, Attacks on wireless Networks.
Phishing and Identity Theft: Introduction, Phishing, Identity Theft.

UNIT-IV
Understanding Computer Forensics: Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-mail, Digital Forensics Life cycle, Chain of Custody Concept, Network Forensics, Approaches a computer Forensics Investigation, Computer Forensics and Steganography, Relevance of the OSI 7 Layer model to computer Forensics, Forensics and social Networking Sites, Computer Forensics from Compliance perspective, Chanllenges in Computer Forensics, Special tools and Techniques, Forensics Auditing, Antiforensics.

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UNIT-V

Cybersecurity Organizational Implications: Introduction, Cost of Cybercrimes and IPR Issues, Web Threats for Organizations, Security and Privacy Implications from Cloud Computing, Social Media Marketing, Social Computing and the Associated challenges for Organizations, Protecting People's Privacy in the Organization, Organizational Guidelines for Internet Usage, Safe Computing Guidelines and Computer Usage Policy, Incident Handling, Forensics Best practices for Organizations.

Text Books:

1. Nina Godbole, Sunit Belapure, "Cyber Security understanding Cyber Crimes, Computer forensics and Legal Perspectives", Wiley India Pvt.Ltd., 2013.
2. Harsh Bothra, "Hacking Be A Hacker with Ethics", Khanna Publishers 2017.

Suggested Reading:

1. William Stallings "Cryptography and Network Security Principles and Practice, 6^{th} Edition, Pearson 2014.
2. Dr.V.K.Jain,"Cryptography and Network Security", 1^{st} Edition, Khanna Book publishing New Delhi 2013.
3. Nina Godbole,"Information Systems Security Security Management, Metrics, Frameworks and Best Practices", Wiley, 2^{nd} Edition, 2012.

Web Resources:

1. https://www.nist.gov/
2. https://www.sans.org/
3. https://www.udemy.com/the-complete-cyber-security-course-end-point-protection/

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18MB C01 **ENGINEERING ECONOMICS AND ACCOUNTANCY**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
The Objectives of the course are:
1. To demonstrate the importance of Managerial Economics in Decision Making.
2. To explain the concept of Accountancy and provide basic knowledge on preparation of Final accounts.
3. To understand the importance of Project Evaluation in achieving a firm's Objective.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Apply fundamental knowledge of Managerial economics concepts and tools.
2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3. Understand production and cost relationships to make best use of resources available.
4. Apply accountancy concepts and conventions and preparation of final accounts.
5. Evaluate Capital and Capital Budgeting decision based on any technique.

Unit-I
Introduction to Managerial Economics: Introduction to Economics and its evolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

Unit-II
Demand and Supply Analysis: Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

Unit-III
Production and Cost Analysis: Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns; Internal and External Economies of Scale.
Cost Analysis: Cost concepts – Types of Costs, Cost-Output Relationship – Short Run and Long Run; Market structures – Types of Competition, Features, Price Output Determination under Perfect Competition, Monopoly and Monopolistic Competition; Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

Unit-IV
Accountancy: Book-keeping, Principles and Significance of Double Entry Book Keeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments. Ratio Analysis.

Unit-V
Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical problems.

Text Books:
1. MehtaP.L.,"Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2016.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 11th Edition, 2013.
3. PandayI.M. "Financial Management", 11th edition, VikasPublishing House, 2015.

18EG O02 **GENDER SENSITIZATION**
(Open Elective – 1)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives
This course will introduce the students to:
1. Sensibility regarding issues of gender in contemporary India.
2. A critical perspective on the socialization of men and women.
3. Popular debates on the politics and economics of work while helping them reflect critically on gender violence.

Course Outcomes
Upon successful completion of this course, students will be able to:
1. Understand the difference between “Sex” and “Gender” and be able to explain socially constructed theories of identity.
2. Recognize shifting definitions of “Man” and “Women” in relation to evolving notions of “Masculinity” and “Femininity”.
3. Appreciate women’s contributions to society historically, culturally and politically.
4. Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
5. Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.

UNIT – I
Understanding Gender:
Gender: Why Should We Study It? *(Towards a World of Equals: Unit -1)*
Socialization: Making Women, Making Men *(Towards a World of Equals: Unit -2)*
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II
Gender And Biology:
Missing Women: Sex Selection and Its Consequences *(Towards a World of Equals: Unit -4)*
Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary *(Towards a World of Equals: Unit -10)*
Two or Many? Struggles with Discrimination.

UNIT – III
Gender and Labour:
Housework: the Invisible Labour *(Towards a World of Equals: Unit -3)*
“My Mother doesn’t Work.” “Share the Load.”
Women’s Work: Its Politics and Economics *(Towards a World of Equals: Unit -7)*
Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV
Issues Of Violence
Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: “*Chupulu”.*
Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.

Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)
Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V
Gender: Co - Existence
Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.
Additional Reading: Rosa Parks-The Brave Heart.

Textbook:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, 2015.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. **"I Fought For My Life…and Won."**Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

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18EE M01 **INDIAN TRADITIONAL KNOWELDGE**

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
Credits	0

Course Objectives:
1. To get a knowledge in Indian Culture.
2. To Know Indian Languages and Literature and the fine arts in India.
3. To explore the Science and Scientists of Medieval and Modern India.

Course Outcomes:
After completion of this course, students will be able to:
1. Understand the culture, civilization, and heritage of Ancient, Medieval and Modern India.
2. Distinguish various Languages and Literature existing in India.
3. Discuss and Compare Philosophy and Religion in Indian since ancient times.
4. Explore various Fine arts in Indian History, and Illustrate the development of Science and Technology in India.
5. Describe the Indian Education System, and recognize the efforts of scientist to the development of India.

UNIT-I
Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT-II
Indian Languages, Culture and Literature:
Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.
Indian Languages and Literature-II: Northern Indian languages & literature.

UNIT-III
Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only).

UNIT-IV
Fine arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India.

UNIT-V
Education system in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India.

Text Books:

1. Kapil Kapoor, Text and Interpretation: The India Tradition, ISBN: 81246033375, 2005.
2. Science in Samskrit, Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007.
3. S. Narain, Examinations in ancient India, Arya Book Depot, 1993.
4. Satya Prakash, Founders of Sciences in Ancient India, Vijay Kumar Publisher, 1989.
5. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978 8120810990, 2014.

Suggested Reading:

1. Kapil Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.

2. Karan Singh, A Treasury of Indian Wisdom: An Anthology of Spiritual Learn, ISBN: 978-0143426158, 2016.

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18IT C24 **ARTIFICIAL INTELLIGENCE LAB**

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To familiarize with search and game playing strategies.
2. To introduce logic programming concepts through Prolog.
3. To learn probabilistic reasoning on uncertain data.
4. To familiarize with supervised learning algorithms.
5. To introduce Natural Language Processing

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Build intelligent agent for search.
2. Implement logic programming.
3. Apply probabilistic reasoning on data.
4. Apply the techniques of supervised and reinforcement learning on data.
5. Perform NLP operations with and without NLTK.

List of Programs

1. Implementation of uninformed and informed search techniques.
2. Implementation of game search.
3. Installation of prolog and demonstration of basic operations.
4. Design of a Bayesian network from given data.
5. Demonstration of supervised learning algorithms.
6. Demonstration of reinforcement learning.
7. Design an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
8. Implementation of simple chatbot.
9. Demonstration of the following operations on text data.
   a. Removal of punctuations in the given string.
   b. Generation of string tokens.
10. Demonstration of the following operations using NLTK.
    a. Removal of stop words for a given passage from a text file.
    b. Stemming for a given sentence.
    c. POS tagging for a given sentence to classify text data.

Text Books:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.
2. Russell, Norvig, “Artificial intelligence - A Modern Approach”, Pearson Education, 3rd Edition, 2015.

Suggested Reading:

1. Rich, Knight, Nair: “Artificial intelligence”, Tata McGraw Hill, 3rd Edition, 2009.
2. Nicole Bauerle, Ulrich Rieder, “Markov Decision Process with Applications to Finance”, Springer, 2011.
3. Nilsson, N., “Artificial Intelligence: A New Synthesis”, Morgan Kaufmann, 1st Edition, 1998.

Web Resources:

1. https://ai.berkeley.edu/project_overview.html
2. http://aima.cs.berkeley.edu/

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18IT C25 **INFORMATION SECURITY LAB**

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:
1. To provide basic cryptography techniques for securing the data.
2. To impart knowledge on symmetric and Asymmetric encryption techniques.
3. To facilitate understanding of digital signatures and key management.
4. To deal with the configuration and use of technologies designed to segregate the organization’s systems from the insecure Network.
5. To familiarize with various security threats that modern organizations face.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Demonstrate encryption and decryption methods using substitution, transposition and product ciphers.
2. Develop the code using symmetric and asymmetric encryption algorithms like AES, Blowfish and Diffie Hellman key exchange.
3. Build the program to calculate the message digest of a text using Hash algorithms like MD5 and SHA1.
4. Construct the code using digital signature algorithm to solve data integrity problems.
5. Experiment with rootkits,wireshark,Nmap to troubleshoot network problems and to develop and test software.

List of Programs
1. Program to implement encryption and decryption using the following:
   a) Substitution cipher b) Transposition Cipher c) Product Cipher
2. Program to implement AES Algorithm.
3. Program to implement Blowfish algorithm.
4. Program to implement the Diffie-Hellman Key exchange algorithm.
5. Program to calculate the message digest of a text using the SHA-1 algorithm.
6. Program to calculate the message digest of a text using the MD5 algorithm.
7. Program to implement Digital Signature algorithm.
8. Demonstrate intrusion detection system using SNORT tool or any other sofware.
9. Installation of rootkits and study about the variety of options.
10. Implement Wireshark to capture the packets and interfaces.
11. Setup a honey pot and monitor the honeypot on network using KF sensor.
12. Demonstrate how to managing securing policies using tcpdump, dumpcap using Wireshark.
13. Demonstration of pentest tools using Nmap, Wireshark.

Text Books:
1. Michael Gregg, "Build Your Own Security Lab" ,Wiley Publishing, Inc.,2008.
2. Michael E.whitman, Herbert J.Mattord,Andrew Green ,”Hands on Information Security lab manual”, Cengage Learning, Fourth edition, December 27, 2013.

Suggested Readings:
1. Alfred Basta, Wolf Halton, "Computer Security, concepts, issues and implementation”, Cengage Learning India Pvt Ltd, 2008.
2. William Stallings, “Cryptography and Network Security principles and practice”, 5th Edition, Pearson Education, Inc., publishing as Prentice Hall 2011.

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Web Resources:

1. https://www.sans.org/security-resources/blogs
2. http://opensecuritytraining.info/HTID.html
3. http://cyber.gatech.edu/research
4. https://www.udemy.com/topic/penetration-testing/
5. https://nmap.org/
6. https://www.bornfortech.net/best-rootkit-remover/
7. https://www.snort.org/
8. https://www.wireshark.org/

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18IT C26 **MINI PROJECT – IV**

Instruction	2 Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

Course Objectives:
1. To enable students to learn by doing.
2. To develop capability to analyse and solve real world problems.
3. To develop innovative ideas among the students

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Interpret Literature with the purpose of formulating a project proposal.
2. Planning, analyzing, Designing and implement a software project using SDLC model.
3. Find the solution of identified problem with the help of modern Technology and give priority to real time scenarios.
4. Plan to work as a team and to focus on getting a working project done and submit a report with in a stipulated period of time.
5. Final Seminar, as oral Presentation before departmental Committee.

The Students are required to implement a project from opted subject in the core elective - 4. During the implementation of the project, Personnel Software Process (PSP) has to be followed. Report of the project work is to be submitted at the end of the Semester for evaluation.

Schedule

S.No	Programming concepts are to be taught related to the courses choosen from core elective – 4	4 weeks
1.	Problem Identification / Selection	2 weeks
2.	Preparation of Abstract	1 week
3.	Design, Implementation & Testing of the Project	5 weeks
4.	Documentation & Project Presentation	2 weeks

Guidelines for the Award of marks

S.No.	Description	Max. Marks
1.	Weekly Assesment	20
2.	PPT Preparation	05
3.	Presentation	10
4.	Question and Answers	05
5.	Report Preparation	10

Final Mini Project demonstration and PPT presentation is to be evaluated for the entire class together by all the faculty handling Mini Project for that class.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
Choice Based Credit System (with effect from 2019-20)
B.E. (Information Technology)

Semester– VII

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week		Scheme of Examination			Credits
			L/T	P/D	Duration of SEE in Hours	Maximum Marks CIE	Maximum Marks SEE	
THEORY								
1	16IT C31	Embedded Systems and Internet of Things	3	-	3	30	70	3
2	16IT C32	Distributed Systems	3	-	3	30	70	3
3	16IT C33	Information Security	3	-	3	30	70	3
4	16IT C34	Big Data Analytics	3	-	3	30	70	3
5		Elective -IV	3	-	3	30	70	3
6		Elective -V	3	-	3	30	70	3
PRACTICALS								
7	16IT C35	Big Data Analytics Lab	-	3	3	25	50	2
8	16IT C36	Embedded Systems and IoT Lab	-	3	3	25	50	2
9	16IT C37	Project Seminar	-	3	-	50	-	2
		TOTAL	18	9	-	280	520	24

L: Lecture T: Tutorial D: Drawing P: Practical
CIE-Continuous Internal Evaluation SEE-Semester End Examination

Elective-IV		
S.No.	**Subject Code**	**Subject Name**
1.	16IT E10	Human Computer Interaction
2.	16IT E11	Soft Computing
3.	16IT E12	VLSI Technology

Elective -V		
S.No.	**Subject Code**	**Subject Name**
1.	16IT E13	Natural Language Processing
2.	16IT E14	Mobile Computing
3.	16IT E15	Business Intelligence

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16ITC 31

EMBEDDED SYSTEMS AND INTERNET OF THINGS

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to

1. Explore theoretical aspects of the design and development of an embedded system.
2. Provide an overview of basic concepts, structure and development of embedded systems using 8051.
3. Familiarize students with programming using 8051 and advanced processors.
4. Facilitate the Internet of Things, building blocks of IoT and the real world applications
5. Acuire knowledge of Raspberry Pi device, its interfaces and Django Framework.
6. Comprehend on domain specific applications of IoT.

Course Outcomes: After successful completion of this course, student will be able to

1. Acquire knowledge and skill in development of embedded systems.
2. Design and develop embedded systems using 8051.
3. Demonstrate real-time and advanced processor concepts.
4. Describe the role of things and Internet in IoT and determine the IoT levels for designing an IoT system.
5. Learn design methodology for IoT system design.
6. Describe about the Raspberry Pi board and interfacing sensors with Rasberry Pi and work with python based web application framework called Django.

Course Prerequisites: Digital Electronics and Logic Design (16ITC04), Computer Organization (16ITC11)

UNIT-I

Embedded Computing: Introduction, Complex Systems and Microprocessor, Embedded System Design Process. The 8051 Architecture: Introduction, 8051

Micro controller Hardware, Input/output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/Output, Interrupts.

UNIT-II

Programming using 8051: Data Transfer and Logical Instructions, Arithmetic Operations, Decimal Arithmetic, Jump and Call Instructions, Applications: Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Introduction to advanced architectures: ARM and SHARC Processor and memory organization, Bus protocols, 12C bus and CAN bus.

UNIT-III

Introduction: Introduction to Internet of Things- Definitions & Characteristics of IoT, Physical Design of IoT-Things in IoT, IoT Protocols, Logical Design of IoT-IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies-Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels& Deployment Templates.

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring. IoT Physical Devices and End Points: Basic building blocks of an IoT device, Raspberry Pi About the board, Raspberry Pi interfaces-Serial, SPI, I2C. Python Web Application Framework: Django Framework-Roles of Model, Template and View.

UNIT-V

Domain Specific IOTs: Various types of IoT Applications in Home Automation-smart lighting, Smart appliance, smoke and gas detectors, Cities, Environment, Energy, Retail, Logistics Agriculture, Industry, Health & Life Style-Wearable Electronics. IoT and M2M – Introduction, M2M, Differences between IoT and M2M, Software Defined Networking, Network Function Virtualization.

Text Books:

1. Wayne Wolf, "Computers as Components", 1st Edition, Academic press, 2001.
2. Kenneth J.Ayala, "The 8051 Microcontroller", 3rd Edition, Thomson, 2014.

3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Raj Kamal, "Embedded Systems", 2nd Edition, McGraw Hill, 2015.
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

Web Resources:

1. https://nptel.ac.in/noc/individual_course.php?id=noc17-cs05
2. www.win.tue.nl/~qingzhiliu/courses/IoT-Msc-2017/Slides/IoT-04-Architecture.pdf

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16IT C32

DISTRIBUTED SYSTEMS

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to

1. Present the basic concepts and principles of distributed systems.
2. Deal with the architectures and models of distributed systems.
3. Familiarize with concepts of processes, threads and various communication methods.
4. Familiarize with concepts of naming, directory services and synchronization in distributed environment.
5. Impart knowledge on the principles of consistency, replication and fault tolerance in distributed systems.
6. Provide understanding of various distributed object based systems.

Course Outcomes: Upon successful completion of the course, student will be able to

1. Describe the various models and architectures of distributed systems.
2. Illustrate use of threads in distributed systems.
3. Comprehend the distributed communication mechanisms.
4. Describe various naming and synchronization mechanism in distributed systems.
5. Analyse consistency, replication and fault tolerance in distributed systems.
6. Compare and contrast various distributed object-based systems.

Course Prerequisites:

Principles of Operating Systems (16ITC16), Computer Networks & Socket Programming (16ITC24)

UNIT – I

Introduction: Definition of A Distributed System; Goals- Making Resources Accessible, Distribution Transparency, Openness, Scalability; Types of Distributed Systems- Distributed Computing Systems, Distributed Information Systems, Distributed Pervasive Systems.

Architectures: Architectural Styles, System Architectures- Centralized Architectures, Decentralized Architectures, Hybrid Architectures; Architectures versus Middleware-Interceptors, General Approaches to Adaptive Software.

UNIT – II

Processes: Threads - Introduction to Threads, Threads in Distributed Systems; Virtualization - The Role of Virtualization In Distributed Systems, Architectures of Virtual Machines; Clients- Networked User Interfaces, Client-Side Software for Distribution Transparency; Servers- General Design Issues, Server Clusters, Managing Server Clusters; Code Migration- Approaches to Code Migration, Migration and Local Resources, Migration in Heterogeneous Systems.

Communication: Fundamentals- Layered Protocols, Types of Communication; Remote Procedure Call- Basic RPC Operation, Parameter Passing, Asynchronous RPC; Message-Oriented Communication- Message Oriented Transient Communication, Message Oriented Persistent Communication; Stream-Oriented Communication- Support for Continuous Media, Streams and Quality of Service, Stream Synchronization; Multicast Communication- Application-Level Multicasting, Gossip-Based Data Dissemination.

UNIT–II

Naming: Names, Identifiers, and Addresses; Flat Naming- Simple Solutions, Home-Based Approaches, Distributed Hash Tables, Hierarchical Approaches; Structured Naming- Name Spaces, Name Resolution, the Implementation of a Name Space; Attribute-based Naming- Directory Services, Hierarchical Implementations: LDAP, Decentralized Implementations.

Synchronization: Clock Synchronization- Physical Clocks, Global Positioning System, Clock Synchronization Algorithms; Logical Clocks- Lamport's Logical Clocks, Vector Clocks; Mutual Exclusion-Overview, A Centralized Algorithm, A Decentralized Algorithm, A Distributed Algorithm, A Token Ring Algorithm, A Comparison of the Four Algorithms; Global Positioning of Nodes; Election Algorithms- Traditional Election Algorithms, Elections in Wireless Environments, Elections in Large Scale Systems.

UNIT – IV

Consistency And Replication: Introduction- Reasons for Replication, Replication as Scaling Technique; Data-Centric Consistency Models- Continuous Consistency, Consistent Ordering of Operations; Client-Centric Consistency Models- Eventual Consistency, Monotonic Reads, Monotonic Writes, Read your Writes, Writes Follow Reads; Replica Management- Replica-Server Placement, Content Replication and Placement, Content Distribution; Consistency Protocols- Continuous Consistency, Primary-Based Protocols, Replicated-Write

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Protocols, A Cache-Coherence Protocols, Implementing Client-Centric Consistency.

Fault Tolerance: Introduction To Fault Tolerance-Basic Concepts, Failure Models, Failure Masking by Redundancy; Process Resilience- Design Issues, Failure Masking and Replication, Agreement in Faulty Systems, Failure Detection; Reliable Client-Server Communication- Point-To-Point Communication, RPC Semantics in The Presence Of Failures; Reliable Group Communication- Basic Reliable-Multicasting Schemes, Scalability in Reliable Multicasting, Atomic Multicast; Distributed Commit-Two-Phase Commit, Three-Phase Commit; Recovery- Introduction, Checkpointing, Message Logging, Recovery-Oriented Computing.

UNIT – V

Distributed Object-Based Systems: Architecture- Distributed Objects, Example: Enterprise Java Beans, Example- Globe Distributed Shared Objects; Processes- Object Servers, Example: The Ice Runtime System; Communication- Binding a Client to an Object, Static versus Dynamic Remote Method Invocations, Parameter Passing, Example: Java RMI, Object-Based Messaging; Naming- CORBA Object References, Globe Object References; Synchronization, Consistency and Replication- Entry Consistency, Replicated Invocations; Fault Tolerance- Example: Fault-Tolerant CORBA, Example: Fault-Tolerant Java; Security- Example: GLOBE, Security for Remote Objects.

Text Books:

1. Andrew S. Tanenbaum and Van Steen "Distributed Systems: Principles and Paradigms", PHI, 2nd Edition, 2014.
2. Colouris G., Dollimore Jean and Kindberg Tim, "Distributed Systems Concepts and Design", Pearson education, 5th Edition, 2012.

Suggested Reading:

1. Sunitha Mahajan, Seema Shah, "Distributed Computing", Oxford University Press, 2nd Edition, 2013.
2. S.Ghosh, Chapman & Hall/CRC, "Distributed Systems", Taylor & Francis Group, 2010.
3. Ajay D. Kshemakalyani, MukeshSinghal, "Distributed Computing, Principles, Algorithms and Systems", Cambridge, 2010.

Web Resource:

1. https://nptel.ac.in/courses/106106168/

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16IT C33

INFORMATION SECURITY

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to

1. Provide basic concepts of Information security and threats its associated attacks.
2. Deal with legal, ethical, professional issues and the role of risk management.
3. Impart knowledge about Information security planning and technology.
4. Facilitate learning of cryptographic algorithms.
5. Acquaint with physical access and oversight of environmental controls.
6. Provide how security policy affects the ongoing technical and administrative evaluation.

Course Outcomes: Upon successful completion of this course, student will be able to:

1. Identify threats that cause harm to assets.
2. Implement laws, ethics that avoids violations in security.
3. Understand security planning and technology.
4. Implement cryptography algorithms to provide security.
5. Understand security issues and the corresponding solutions.
6. Implement information security,employment policies and practices.

Course Prerequisites: Data Communications (16IT C09)

UNIT – I

Introduction to Information Security: History of Information Security, What Is Security,CNSS security model,Components of an Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, Security in the Systems Life Cycle, Security Professionals and the Organization.

Need for Security: Business needs, Threats and Attacks, Compromises to Intellectual Property, Deviations in Quality of Service, Espionage or Trespass, Forces of Nature, Human Error or Failure, Information Extortion, Sabotage or Vandalism, Software Attacks, Technical Hardware Failure or Errors,Technical Software Failure or Errors, Technological Obsolescence, Theft.

UNIT – II

Legal, Ethical and Professional Issues in Information Security: Introduction, Law and Ethics in Information Security, Relevant U.S Laws, International Laws and Legal Bodies,Ethics and Information Security, Codes of Ethics at Professional Organization, Key U.S.Federal Agencies.

Risk management: An Overview of Risk Management, Risk Identification, Risk assessment, Risk Control, Quantatitive versus Qualitative Risk Management Practices, Recommended Risk Control Practices.

UNIT – III

Planning for Security: Introduction, Information Security Planning and Governance, Information Security Policy, Standards and Practices, the Information Security Blue Print, Security Education, Training and Awareness Program, Continuity Strategies.

Security Technology: Introduction, Access Control, Firewalls, Intrusion detection and prevention systems, Honey pots,Honey nets, Padded Cell Systems, Scanning and Analysis Tools.

UNIT – IV

Cryptography: Introduction, Foundations of Cryptology, Cipher methods, cryptographic Algorithms Cryptographic Tools, Protocols for Secure Communications.

Physical Security: Introduction,Physical Access Controls,Fire Security and Safety,Failure of Supporting Utilities and Structural Collapse, Interception of Data,Securing Mobile and Portable Systems,Special Considerations for Physical Security

UNIT – V

Implementing Information Security: Introduction, Information Security Project Management, TechnicalAspects of Implementation, Non technical Aspects of Implementation, Information Systems Security Certification and Accreditation.

Security and Personnel: Introduction,Positioning and Staffing Security Function, Employment Policies and Practices, Security Considerations for Temporary Employees, Consultants and Other Workers, Internal Control Strategies, Privacy and the Security of Personnel Data

Information security Maintenance: Introduction, Security Management Maintenance Models, Digital Forensics.

Text Books:

1. Michael E. Whitman, Hebert J Mattord, "Principles of Information Security", 5th Edition, Cengage Learning, 2014.
2. Thomas R Peltier, Justing Peltier, JohnBlackley, "Information Security Fundamentals", Auerbacj Publications, 2010.
3. William Stallings "Cryptography and Network Security Principles and Practice", 6th Edition, Pearson, 2014.

Suggested Reading:

1. Dr.V.K.Jain,"Cryptography and Network Security", 1st Edition, Khanna Book publishing, 2013.
2. Marks Merkow, Jim Breithaupt, "Information Security: Principle and Practices", 2nd Edition, Pearson Education, 2014.

Web Resources:

1. https://www.sans.org/security-resources/
2. https://nptel.ac.in/courses/106106129/

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16IT C34

BIG DATA ANALYTICS

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to

1. To explain the importance of big data, role of Hadoop framework in analyzing large datasets.
2. To gain knowledge of writing mapper and reducer for a given problem.
3. To provide the concepts of NoSQL databases and the working mechanisms of MongoDB.
4. To familiarize writing queries in Pig and Hive to process big data.
5. To discuss the concept and writing applications using Spark
6. To acquaint with Scala Programming constructs

Course Outcomes: Upon successful completion of the course, student will be able to

1. Understand processing large datasets in Hadoop framework.
2. Develop applications using MapReduce framework to solve real world problems.
3. Develop data models using MongoDB.
4. Develop scripts using Pig to process large datasets and understand querying using hive from a data warehouse.
5. Understand the fundamentals of the Spark and expertise in using Resilient Distributed Datasets (RDD) for creating applications in Spark.
6. Develop functional programs using Scala.

Course Prerequisites: Java Programming (16ITC10), Python Programming (16ITE01)

UNIT – I

Introduction to Big Data: Importance of Big Data, when to considerBig Data as a solution, Big Data use cases: IT for IT Log Analytics, the Fraud Detection Pattern, and Social Media Pattern.

The Hadoop Distributed Files system: The Design of HDFS, HDFS Concepts, Blocks, Name nodes and Data nodes, Block Caching, HDFS Federation, HDFS

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High Availability, The Command-Line Interface, Basic File system Operations, Hadoop File systems, Interfaces, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the File System API, Writing Data, Directories, Querying the File system, Deleting Data, Data Flow, Anatomy of a File Read, Anatomy of a File Write.

UNIT – II

MapReduce: What is Map reduce, Architecture of map reduce.**How MapReduce Works**: Anatomy of a MapReduce Job Run, Job Submission, Job Initialization, Task Assignment, Task Execution, Progress and Status Updates, Job Completion, Failures, Task Failure, Application Master Failure, Node Manager Failure, Resource Manager Failure, Shuffle and Sort, The Map Side, The Reduce Side, MapReduce Types and Formats: MapReduce Types, The Default MapReduce Job, Input Formats,Input Splits and Records, Text Input, Output Formats, Text Output.

Developing MapReduce Applications on contemporary problems.

UNIT – III

No SQL Databases: Review of traditional Databases, Need for NoSQL Databases, Columnar Databases, Failover and reliability principles, CAP Theorem, Differences between SQL and NoSQL databases.

Working mechanisms of Mongo DB: Overview, Advantages, Environment, Data Modeling, Create Database, Drop Database, Create collection, Drop collection, Data types, Insert, Query, Update and Delete operations, Limiting and Sorting records, Indexing, Aggregation.

UNIT – IV

Pig: Installing and Running Pig, an Example, Generating Examples, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators, Pig in Practice.

Hive: Installing Hive, The Hive Shell, An Example, Running Hive, Comparison with Traditional Databases, HiveQL, Tables, Querying Data, User-Defined Functions, Writing a User Defined Functions, Writing a User Defined Aggregate Function.

UNIT – V

Spark: Importance of Spark Framework, Components of the Spark unified stack, Batch and Real-Time Analytics with Apache Spark, Resilient Distributed Dataset (RDD), SCALA (Object Oriented and Functional Programming)**Scala**: Scala Environment Set up, Downloading and installing Spark standalone, Functional Programming, Collections.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 4^{th} Edition, O'Reilly Media Inc, 2015.
2. Tanmay Deshpande, "Hadoop Real-World Solutions Cookbook", 2^{nd} Edition, Packt Publishing, 2016.

Suggested Reading:

1. Thilinagunarathne,"Hadoop MapReduce v2 Cookbook", 2^{nd}Edition, Packet Publishing, 2015.
2. Chuck Lam, Mark Davis, AjitGaddam, "Hadoop in Action", Manning Publications Company, 2016.
3. Alan Gates, "Programming Pig", O'Reilly Media Inc, 2011.

Web Resources:

1. http://www.planetcassandra.org/what-is-nosql
2. http://www.iitr.ac.in/media/facspace/patelfec/16Bit/index.html
3. https://class.coursera.org/datasci-001/lecture
4. http://bigdatauniversity.com

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16IT E10

HUMAN COMPUTER INTERACTION

(Elective - IV)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: This Course is introduced to

1. Present the characteristics of graphical and web user interface, design and system menus.
2. Facilitate learning of different kinds of windows, device based and screen based controls.
3. Familiarize with feedback, internationalization, color, graphics, images and icons.
4. Impart knowledge about prototype modelling for an interactive product.
5. Impart knowledge about the structure and the representational dynamics of the cognitive system interacting with the computer.
6. Discuss interaction design and evaluation framework.

Course Outcomes: Upon successful completion of the course, student will be able to

1. Comprehend the characteristics of Graphical and web user interface, design and system menus.
2. Choose proper kinds of windows, device based and screen based controls.
3. Understand feedback, internationalization, color, graphics, images and icons.
4. Describe prototype modelling methods.
5. Demonstrate an understanding of principles, and theories influencing human computer interaction.
6. Understand the role of text, sound and touch in interaction design.

Course Prerequisites: IT Workshop (18ITC08)

UNIT – I

The Importance of the User Interface: Defining the User Interface, The Importance of Good Design, **Characteristics of Graphical and Web User Interfaces:** The

Graphical User Interface, The Web User Interface: Characteristics of a Web Interface, **Principles of User Interface Design:** General Principles.
The User Interface Design Process: Obstacles and Pitfalls in the Development Path, Usability, the Design Team, **Know Your User or Client:** Understanding How People Interact with Computers, Important Human Characteristics in Design, Human Considerations in Design, Human Interaction Speeds, Methods for Gaining an Understanding of Users, **Understand the Principles of Good Screen Design:** Human Considerations in Screen Design, **Develop System Menus and Navigation Schemes:** Structures of Menus, Functions of Menus, Content of Menus, Formatting of Menus, Phrasing the Menu, Selecting Menu Choices, Kinds of Graphical Menus

UNIT – II
Select the Proper Kinds of Windows: Window Characteristics, Components of a Window, Window Presentation Styles, Types of Windows, Window Management, Organizing Window Functions, Window Operations, **Select the Proper Device-Based Controls:** Characteristics of Device-Based Controls, **Choose the**
Proper Screen-Based Controls: Operable Controls, Text Entry/Read-Only Controls, Combination Entry/Selection Controls, Other Operable Controls, Presentation Controls, Selecting the Proper Controls, **Write Clear Text and Messages.**

UNIT – III
Provide Effective Feedback, Guidance and Assistance, Provide Effective Internationalization and Accessibility, Create Meaningful Graphics, Icons and Images, Choose the Proper Colors, Organize and Layout Windows and Pages.

UNIT – IV
Interaction Design – Introduction, Goals of Interaction Design, Heuristics and Usability principles, **Conceptualizing interaction:** Problem Space, conceptual models, interface metaphors, paradigms. **Understanding Users**: cognition, Conceptual frame works for cognition, **Collaboration and Communication:** Social mechanisms, Conceptual frameworks.

UNIT – V
Understanding how interfaces affect users: Affective aspects, Expressive interfaces, User frustration, Agents, **Process of Interaction Design:** What is interaction design about? Life cycle models, **Design, prototyping and**
Construction: Prototyping and construction, Conceptual Design, Physical Design, **Introducing Evaluation:** Introduction, What, Why and when to evaluate, **Evaluation Framework, Testing and modeling users.**

Text Books:

1. Wilbert O. Galitz, "The essential guide to User Interface Design", Wiley Dreamtech, 2002.
2. Sharp, Rogers, Preece, "Interaction Design", 2nd Edition, John Wiley, 2008
3. Steven Heim, "The Resonant Interface: HCI Foundations for Interaction Design", Addison-Wesley, 2007.

Suggested Reading:

1. J. Preece, Y. Rogers, and H. Sharp, "Interaction Design: Beyond Human-Computer Interaction", Wiley & Sons, 2nd Edition, 2007.
2. Ben Shneiderman,Catherine Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 5th Edition, Addison-Wesley, 2009.

Web Resources:

1. http://openclassroom.stanford.edu/MainFolder CoursePage.php?course=HCI
2. http://hcibib.org/hci-sites/history
3. http://www.hcirn.com/tutor/index.php

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16IT E13

NATURAL LANGUAGE PROCESSING

(Elective -V)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course introduces

1. Theoretical concepts of language processing that shows how to explore interesting bodies of text.
2. Fundamental topics in language processing that include tagging, classification, and information extractionusing tiny Python programs.
3. Formal grammar to describe the structure of an unlimited set of sentences.
4. Methods to parse a sentence, recognize its syntactic structure and construct representations of meaning.
5. Effective management of linguistic data.
6. Design of existing corpora, the typical workflow forcreating a corpus and the life cycle of a corpus.

Course Outcomes: Upon successful completion of this course, student will be able to

1. Comprehend the concept of natural language processing, its challenges and applications.
2. Demonstrate skills in natural language processing using the Python programming language and the Natural Language Toolkit (NLTK) open source library.
3. Extract information from unstructured text, either to guess the topic or identify "named entities".
4. Analyze linguistic structure in text, including parsing and semantic analysis.
5. Access popular linguistic databases, including WordNet and treebanks.
6. Integrate techniques drawn from fields as diverse as linguistics and artificial intelligence.

Course Prerequisites: Python Programming (16ITE01)

UNIT–I

Language Processing: Computing with Language- Texts and Words, A Closer Look at Python: Texts as Lists of Words, Computing with Language- Simple Statistics, Automatic Natural Language Understanding, **Accessing Text Corpora and Lexical Resources**: Accessing Text Corpora, Conditional Frequency Distributions, Lexical Resources, Word Net

UNIT–II

Processing Raw Text: Strings- Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation, Formatting: From Lists to Strings **Categorizing and Tagging Words:** Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging, Transformation-Based Tagging

UNIT–III

Learning to Classify Text: Supervised Classification, Evaluation, Modeling Linguistic Patterns, **Extracting Information from Text**: Information, Chunking, Developing and Evaluating Chunkers Recursion in Linguistic Structure .

UNIT–IV

Analyzing Sentence Structure: Context-Free Grammar, Parsing with Context-Free Grammar,Dependencies and Dependency Grammar, Grammar Development **Building Feature-Based Grammars:** Grammatical Features,Processing Feature Structures,Extending a Feature-Based Grammar

UNIT–V

Analyzing the Meaning of Sentences: Natural Language Understanding, Propositional Logic, First-Order Logic, the Semantics of English Sentences. **Managing Linguistic Data: Corpus** Structure: A Case Study, the Life Cycle of a Corpus, Acquiring Data.

Text Book:

1. Steven Bird, Evan Klein, Edward Loper, "Natural Language Processing with Python", O'Reilly Media, Inc., 2009.

Suggested Reading:

1. Daniel Jurafsky, James H Martin. "Speech and Language Processing", 2nd Edition, Pearson Education, 2009.
2. Nitin Indurkhya, Fred J. Damerau, "Handbook of Natural Language Processing", 2nd Edition, Chapman and Hall/CRC Press, 2010.
3. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
4. Nitin Hardaniya, Jacob Perkins, "Natural Language Processing: Python and NLTK", Packt Publishers, 2016.

Web Resources:

1. https://pythonprogramming.net/tokenizing-words-sentences-nltk-tutorial/
2. http://www.nptelvideos.in/2012/11/natural-language-processing.html
3. https://github.com/keon/awesome-nlp

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16IT E14

MOBILE COMPUTING

(Elective -V)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to

1. Familiarize with Cellular concepts and medium access mechanisms for wireless systems.
2. Deal with features of a range of mobile devices and systems.
3. Facilitate understanding of Network layer functions for mobile systems.
4. Acquaint with functions of transport layers for mobile communication systems.
5. Provide understanding of database hoarding techniques, data dissemination techniques.
6. Impart knowledge on Data Synchronization techniques for mobile computing systems.

Course Outcomes: Upon successful completion of this course, student will be able to

1. Discuss the cellular concepts, techniques for improving cellular system capacity and medium access control.
2. Describe the features of a wide variety of mobile devices and systems.
3. Understand Mobile IP, packet delivery and Dynamic Host Configuration Protocol
4. Analyze different variations of TCP for mobile communication systems.
5. Describe database hoarding and data dissemination techniques.
6. Elaborate the rules for Data Synchronization in mobile computing systems.

Course Prerequisites: Computer Networks and Socket Programming (16ITC24)

UNIT–I

Introduction: Challenges in mobile computing, Coping with uncertainties, resource poorness, bandwidth, etc. Cellular architecture, Co-channel interference, Frequency reuse, Capacity increase by cell splitting.

16IT E15

BUSINESS INTELLIGENCE

(Elective -V)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to

1. Focus on designing and building a business intelligent system.
2. Acquaint with advanced database techniques.
3. Acquire and understand mathematical concepts to develop data centric decision models.
4. Design and develop data Warehouse using Various Schema and Dimensional modelling.
5. Design data architectures.
6. Familiarize with differentreport generating techniques.

Course Outcomes: After successful completion of this course, student will be able to

1. Gain knowledge in the theory, principles and applications of business intelligent system.
2. Design and implement OLTP, OLAP and Warehouse concepts.
3. Design a data model and use relevant techniques for data analysis
4. Use Analytics concepts like data mining, Exploratory and statistical techniques for predictive analysis in Business Intelligence.
5. Represent different data Architectures.
6. Build Business Intelligence reports.

Course Prerequisites: Database Systems (16ITC17), Data Warehousing and Data Mining (16ITC25)

UNIT–I

Business Intelligence And Its Impact : Introduction, Information Pyramid – Data, Information, Knowledge, What is Business Intelligence,Factors Driving Business Intelligence,Business Intelligence And Related Technologies, Business Intelligence in Contemporary Organizations,Obstacles To Business Intelligence.

UNIT–II

Business Intelligence Capabilities: Four Synergic Capabilities, Organizational Memory,Information Integration, Insight Creation,Presentation.
Technologies Enabling Organizational Memory: Data Warehouse: ER Modeling,

Dimensional Modeling, Designing Enterprise Architecture, Knowledge Repositories.

UNIT–III

Representation of Data in Data Warehouse: Dimensional Modelling:The STAR and SNOWFLAKE schema, Pros & Cons of the STAR/SNOWFLAKE Schema.
Technologies Enabling Presentation: Online Analytical Processing(OLAP), Online Transaction Processing(OLTP)**,** OLAP Versus OLTP, Impact Of Business Intelligence On Corporate Performance,
The Central Repository – Meta data, Information Consumption User Interfaces – Desktop Vs. Web Vs. Mobile, Open Architecture, Scalability, Performance in BI – In Memory Analytics.

UNIT-- V

BI Project Life cycle: Typical BI Project Life cycle, Requirements Gathering & Analysis – Functional & Non Functional Requirements, Reports & Dashboards Design – Mock-up and Story boarding, testing in a BI Project, BI Project Deployment, and Post Production Support.

UNIT– V

Introduction to Enterprise Class: BI Tool First Level of Abstraction of the Data Warehouse in Micro Strategy, **Building the Schema Objects** – Attributes, Facts, Transformation & Hierarchies, **Building Reusable Application Objects** – Metrics, Filters, Prompts, Five Styles of BI, Building Reports – Grids & Graphs, Report Manipulation over the Web – Pivoting, Sorting, Drilling, Exporting etc., Setting up Report Distribution, Report Project.

Text Books:

1. Sabherwal R. and Becerra-Fernandez I., “Business Intelligence”, Wiley.
2. R. Sharda, D. Delen, E. Turban, “Business Intelligence and Analytics: Systems for Decision Support”, 10th Edition, Pearson/Prentice Hall.

Suggested Reading:

1. Kimball R., Ross M., “The Kimball Group Reader: Relentlessly Practical Tools for Data Warehousing and Business Intelligence”, Wiley and Sons, 2010.
2. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2009.
3. Jim Mazzullo,”SAP R/3 for Everyone”, Pearson, 2007.

Web Resources:

1. http://www.teradatamagazine.com/v13n01/Features/A-Better-Data-Plan/ (accessed September 2013).
2. https://www.youtube.com results?search_query=Business+Analytic+and+intelligence
3. https://www.youtube.com results?search_query=Business+Analytic+and+intelligence+IIT

16IT C35

BIG DATA ANALYTICS LAB

Instruction	3P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: This course is introduced to

1. Provide the knowledge to setup a Hadoop Cluster.
2. Impart knowledge to develop programs using MapReduce.
3. Discuss Pig, PigLatin and HiveQL to process big data.
4. Familiarize with NoSQL databases.
5. Presentlatest big data frameworks and applications using Spark and Scala.
6. IntegrateHadoop with R (RHadoop) to process and visualize.

Course Outcomes: Upon successful completion of this course, student will be able to

1. Understand Hadoop working environment.
2. Work with big data applications in multi node clusters.
3. Apply big data and echo system techniques for real world problems.
4. Write scripts using Pig to solve real world problems.
5. Write queries using Hive to analyze the datasets
6. Understand spark working environment.

Course Prerequisites: Java Programming (16ITC10), Python Programming (16ITE01)

List of Programs

1. Understanding and using basic HDFS commands
2. Word count application using Mapper Reducer on single node cluster
3. Analysis of Weather Dataset on Multi node Cluster using Hadoop
4. Real world case studies on Map Reduce applications
5. Working with files in Hadoop file system: Reading, Writing and Copying
6. Writing User Defined Functions/Eval functions for filtering unwanted data in Pig
7. Working with Hive QL

8. Writing User Defined Functions in Hive
9. Understanding the processing of large dataset on Spark framework.
10. Integrating Hadoop with other data analytic framework like R

Text Books:

1. Tom White, “Hadoop: The Definitive Guide”, 4th Edition, O’Reilly Inc, 2015.
2. Tanmay Deshpande, “Hadoop Real-World Solutions Cookbook”, 2nd Edition, Packt Publishing, 2016.

Suggested Reading:

1. Edward Capriolo, Dean Wampler, and Jason Rutherglen, “Programming Hive”, O’Reilly Inc, 2012.
2. VigneshPrajapati, “Big data Analytics with R and Hadoop”, Packt Publishing, 2013.

Web Resources:

1. https://parthgoelblog.wordpress.com/tag/hadoop-installation
2. http://www.iitr.ac.in/media/facspace/patelfec/16Bit/index.html
3. https://class.coursera.org/datasci-001/lecture
4. http://bigdatauniversity.com

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16IT C36

EMBEDDED SYSTEMS AND IOT LAB

Instruction	3P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: This course is introduced to

1. Familiarize withinterfacing LEDs and switches using 8051 Microcontroller.
2. Aquaint with interface controls using 8051.
3. Explore design and development of an embedded system
4. Know the interfacing programs using Python.
5. Understand the applications using Raspberry Pi3.
6. Provide necessary knowledge to develop working code for real-world IoT applications.

Course Outcomes: Upon successful completion of this course, student will be able to

1. Possess the passion for acquiring programming skills in using different tools.
2. Able to design and develop embedded systems (hardware, peripherals and firmware).
3. Write code for different forms of interfacing devices.
4. Develop python programs that run on Raspberry Pi3
5. Interface Sensors and Actuators with Raspberry Pi3
6. Develop simple IoT systems using Raspberry Pi3 device and appropriate sensors and Django Framework.

Course Prerequisites: Microprocessors (16ITC11) and Python Programming (16ITE01).

List of Experiments

A. Use of 8-bit and 32-bit Microcontrollers, (such as 8051 Microcontroller, ARM2148 / ARM2378, LPC 2141/42/44/46/48) and C compiler (Keil, Ride etc.) to:
   1. Interface Input-Output and other units such as: Relays, LEDs, LCDs, Switches, Keypads, Stepper Motors, and ADCs.

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   2. Develop Control Applications such as: Temperature Controller, Elevator Controller, Traffic Controller

B. Internet of Things (IoT) Experiments

Following are some of the programs that a student should be able to write and test on Raspberry Pi

1. Switching LED on/off from Raspberry Pi Console.
2. Interfacing an LED and Switch with Raspberry Pi.
3. Interfacing a Light Sensor with Raspberry Pi.
4. Interfacing Rain Sensing Automatic Wiper System.
5. Interfacing to identify accident and send alert messages.
6. Interfacing smoke sensor to give alert message to fire department.
7. Implementation of Traffic Light System based on density, to decrease congestion.
8. Design and develop IoT Solar Power Monitoring System.
9. Design and develop Patient health monitoring system.
10. Implementation of Home Automation System using WiFi Module.

Text Books:

1. Kenneth J.Ayala, “The 8051 Microcontroller”, 3rd Edition, Thomson, 2014.
2. ArshdeepBahga, Vijay Madisetti, “Internet of Things: A Hands-on Approach”, Universities Press, 2014.

Suggested Reading:

1. Raj Kamal, “Embedded Systems”, 2nd Edition, McGraw Hill, 2015.
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1stEdition, Academic Press, 2014.
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.

Web Resources:

1. https://www.edgefx.in/8051-microcontroller-architecture/
2. http://www.circuitbasics.com/raspberry-pi-ds18b20-temperature-sensor-tutorial/
3. https://raspberrypihq.com/making-a-led-blink-using-the-raspberry-pi-and-python/

16IT C37

PROJECT SEMINAR

Instruction	3P Hours per week
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/ Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks:

Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

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B.E. (Information Technology)

Semester– VIII

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per Week		Scheme of Examination			Credits
					Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1		Elective-VI	3	-	3	30	70	3
2		Open Elective-I	3	-	3	30	70	3
3		Open Elective-II	3	-	3	30	70	3
4	16ITC 38	Seminar	3	-	-	50	-	2
5	16ITC 39	Project	-	6	Viva-Voce	50	100	6
		TOTAL	12	6	-	190	310	17

L: Lecture T: Tutorial D: Drawing P: Practical
CIE-Continuous Internal Evaluation SEE-Semester End Examination

Elective-VI		
S.No.	Subject Code	Subject Name
1.	16ITE 16	Virtual Reality
2.	16ITE 17	Social Media Analytics
3.	16ITE 18	Cloud Computing

Open Elective-I		
S.No.	Subject Code	Subject Name
1.	16MEO 02	Robotics
2.	16MEO 04	Intellectual Property Rights
3.	16MEO 06	Research Methodologies
4.	16MEO 07	Introduction to Operations Research

Open Elective-II		
S.No.	Subject Code	Subject Name
1.	16MEO 01	Entrepreneurship
2.	16MEO 03	Human Rights and Legislature Procedures
3.	16CEO 02	Disaster Mitigation and Management
4.	16EGO 02	Gender Sensitization

16IT E17

SOCIAL MEDIA ANALYTICS

(Elective -VI)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course is introduced to

1. Present basics of Social media mining and challenges in mining social media data.
2. Discuss graph essentials, network essentials and network models for social media mining.
3. Deal with the process of detecting, analyzing communities and Information diffusion in the context of Social media analytics.
4. Impart knowledge about mining essentials and importance of influence and homophily.
5. Discuss recommendation systems in the context of social media.
6. Present the working of prediction systems.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand and analyze the challenges posed by social media data.
2. Represent social media using a suitable network model.
3. Perform community analysis and analyze herd behavior.
4. Model, measure and distinguish between influence and homophily.
5. Understand and build recommendation systems.
6. Understand how a prediction system works.

UNIT–I

Introduction: Social Media Mining, New Challenges for Mining.
Graph Essentials: Graph Basics, Graph Representation, Types of Graphs, Connectivity in Graphs, Special Graphs, Graph Algorithms,
Network Measures: Centrality, Transitivity and Reciprocity, Balance and Status, Similarity, Network Models: Properties of Real-World Networks, Random Graphs, Small-World Model, Preferential Attachment Model.

UNIT–II

Community Analysis: Community Detection, Community Evolution, Community Evaluation, Information**Diffusion in Social Media:** Herd Behaviour, Information Cascades, Diffusion of Innovations, Epidemics.

UNIT–III

Data Mining Essentials: Data, Data Preprocessing, Data Mining Algorithms, Supervised Learning, Unsupervised Learning,
Influence and Homophily: Measuring Assortativity, Influence, Homophily, Distinguishing Influence and Homophily.

UNIT–V

Recommendation in Social Media: Challenges, Classical Recommendation Algorithms, Recommendation Using Social Context, Evaluating Recommendations, Behavior Analytics: Individual Behavior, Collective Behavior.

UNIT–V

Prediction: Predicting the future, Prediction of learning, Predicting elections, Predicting Box offices, Predicting Stock market, Closing predictions.

Text Books:

1. Zafarani R., Abbasi M.A., Liu H, "Social Media Mining: An Introduction", Cambridge University Press, 2014.
2. Lutz Finger, Soumitra Dutta, "Ask, Measure, Learn: Using Social Media Analytics to Understand and Influence Customer Behavior", O'Reilly Media, 2014.

Suggested Reading:

1. David Easley and Jon Kleinberg, "Networks, Crowds and Markets", Cambridge University Press, 2010
2. Bing Liu, "Sentiment Analysis: mining opinions, sentiments, and emotions", Cambridge University Press, 2015.
3. Matthew A. Russell, "Mining the Social Web: Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites", O'Reilly Media 2011.

Web Resources:

1. http://www.kdd.org/kdd2015/tutorial.html
2. http://thinktostart.com/category/social-media/
   http://blogs.iit.edu/iit_web/social-media-2/social-media-whats-your-strategy/4

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UNIT– I

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT– III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT– IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights.Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT– V

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.

Unfair Competition: What is unfair competition.Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications", Macmillan India ltd , 2006.
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications", Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan, "Law of Copyright and Industrial Designs", Eastern law House, Delhi 2010.

Suggested Reading:

1. W.R1 Cronish, "Intellectual Property; Patents, copyright, Trad and Allied rights", Sweet & Maxwell, 1993.
2. P. Narayanan, "Intellectual Property Law", Eastern Law Edition, 1997.
3. Robin Jacob and Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs", 4th Edition, Sweet, Maxwell.

16ME O06

RESEARCH METHODOLOGIES

(Open Elective - I)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To make the students to formulate the research problem
2. To identify various sources for literature review and data collection.
3. To prepare the research design
4. To equip the students with good methods to analyze the collected data
5. To explain how to interpret the results and report writing

Course Outcomes: At the end of the course, the students are able to

1. Define research problem
2. Review and asses the quality of literature from various sources.
3. Understand and develop various research designs.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Improve the style and format of writing a report for technical paper/ Journal report

UNIT– I

Research Methodology: Objectives and Motivation of Research, Types of Research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research Approaches, Significance of Research, Research Methods verses Methodology, Research process, Criteria of Good Research, Problems Encountered by Researchers in India, Technique involved in defining a problem.

UNIT–-I

Literature Survey: Importance of Literature Survey, Sources of Information-primary, secondary, tertiary, Assessment of Quality of Journals and Articles, Information through Internet.

UNIT– III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Steps in sample design

UNIT-IV

Data Collection: Collection of primary data, Secondary data, Measures of central tendency-mean, mode, median, Measures of dispersion- Range, Mean deviation, Standard deviation, Measures of asymmetry (skewness), Important parametric tests -z, t, F, Chi-Square, ANOVA significance

UNIT-V

Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation- Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique", New Age International Publishers, 2004.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011.

Suggested Reading:

1. Vijay Upagade and Aravind Shende, "Research Methodology", S. Chand & Company Ltd., New Delhi, 2009.
2. G. Nageswara Rao, "Research Methodology and Quantitative methods", BS Publications, Hyderabad, 2012.
3. Ratan Khananabis and Suvasis Saha, "Research Methodology", Universities Press, Hyderabad, 2015.

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16ME O07

INTRODUCTION TO OPERATIONS RESEARCH

(Open Elective - I)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Students will come to know the formulation of LPP models.
2. Students will understand the Algorithms of Graphical and Simplex Methods.
3. Students will understand the Transportation and Assignment techniques.
4. Students will come to know the procedure of Project Management along with CPM and PERT techniques.
5. Students will understand the concepts of sequencing.

Course Outcomes: At the end of the course, the students were able to

1. Formulate a managerial decision problem into a mathematical model.
2. Apply transportation problems in manufacturing industries.
3. Build and solve assignment models.
4. Apply project management techniques like CPM and PERT to plan and execute project successfully.
5. Apply sequencing concepts in industry applications.

UNIT–I

Introduction: Definition and Scope of Operations Research.

Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method

UNIT–II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Unbalanced Transportation problem, Degeneracy in Transportation,

UNIT–II

Assignment Techniques: Introduction, Hungarian technique of Assignment techniques, unbalanced problems, problems with restrictions, Maximization in Assignment problems.

16EG O02

GENDER SENSITIZATION

(Open Elective - II)

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will introduce the students to:

1. To develop students' sensibility with regard to issues of gender in contemporaryIndia.
2. To provide a critical perspective on the socialization of men and women.
3. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course Outcomes : After successful completion of the course the students will be able to:

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived fromresearch, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

UNIT – I

Understanding Gender:

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)

Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)

Introduction.Preparing for Womanhood.Growing up Male.First lessons in Caste. Different Masculinities.

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UNIT – II

Gender And Biology:

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)

Declining Sex Ratio.Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)

Two or Many?Struggles with Discrimination.

UNIT–III

Gender andLabour:

Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)

"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)

Fact and Fiction.Unrecognized and Unaccounted work. Additional Reading: Wages and
Conditions of Work.

UNIT– V

Issues Of Violence

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading:
"*Chupulu*".

Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading:
New Forums for Justice.

Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)

Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of
Violence.

UNIT–V

Gender: Co - Existence

Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.

Additional Reading: Rosa Parks-The Brave Heart.

Text Book:

1. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, 2015.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012.

Web Resources:

1. Abdulali Sohaila. "I Fought For My Life…and Won." http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/
2. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
3. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

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16IT C38

SEMINAR

Instruction	3Hours per week
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summaryand Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

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16IT C39

PROJECT

Instruction	6 Hours per week
CIE	50 Marks
SEE	100 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned
2. Review and finalization of the Approach to the Problem relating to the assigned topic
3. Preparing an Action Plan for conducting the investigation, including team work
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/ Experiment as needed
5. Final development of product/process, testing, results, conclusions and future directions
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible
7. Preparing a Dissertation in the standard format for being evaluated by the Department
8. Final Seminar presentation before Departmental Committee

Guidelines for the award of marks in CIE: (Max. Marks: 50)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project ● Innovations ● Applications ● Live Research Projects ● Scope for future study ● Application to society
	20	Viva-Voce

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16IT O01

OBJECT ORIENTED PROGRAMMING USING JAVA

(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To familiarize with fundamentals of object-oriented programming paradigm.
2. To impart the knowledge of string handling, interfaces, packages and inner classes.
3. To facilitate learning Exception handling and Multithreading mechanisms.
4. To gain knowledge on collection framework, stream classes.
5. To familiarize with event driven GUI programming and Database connectivity.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand Object-Oriented concepts.
2. Create Java applications using sound OOP practices e.g. Inheritance, Interfaces, Packages, and Inner Classes.
3. Implement Exception Handling and Multithreading concepts in java programs.
4. Develop programs using the Java CollectionAPI and Stream classes.
5. Design and Develop GUI applications with the integration of event handling, JDBC.

UNIT–I

OOP concepts - Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, Procedural and object oriented programming paradigms.

Introduction to Java: Java's Magic: The Byte code, The Java Buzzwords, Simple Java Programs, Java Primitive Types, Arrays: How to create and define arrays, Basic Operators, Control statements.

Introducing Classes: Declaring objects, methods, Constructors, this keyword, Method Overloading and Constructor Overloading, Objects as parameters, Returning objects, Use of static and final keywords.

20MT C01

LINEAR ALGEBRA & CALCULUS

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block chain Technology))

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To explain the solutions of system of linear equations by Matrix Methods.
2. To discuss the convergence and divergence of the Series.
3. To explain the Partial Derivatives and the extreme values of functions of two variables
4. To discuss Physical interpretations on Scalars and vector functions
5. To discuss vector line, surface and volume integrals.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the Matrix Methods to solve the system of linear equations
2. Test the convergence and divergence of the infinite Series.
3. Determine the extreme values of functions of two variables.
4. Apply the vector differential operator to scalar and vector functions
5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.

UNIT-I

Matrices: Rank of a matrix, Echelon form, consistency of linear System of equations, Linear dependence of vectors, Eigen values, Eigenvectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-II

Infinite Series: Definition of Convergence of sequence and series. Series of positive terms –Necessary condition for convergence, Comparison tests, limit form comparison test, D'Alembert's Ratio test, Raabe's test, Cauchy's root test, alternating series, Leibnitz's rule, absolutely and conditionally convergence.

UNIT-III

Partial Differentiation and Its Applications: Functions of two or more variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions, Jacobians, Taylor's expansion of functions of two variables, Maxima and minima of functions of two variables.

UNIT-IV

Vector Differential Calculus: Scalar and vector point functions, vector operator Del, Gradient, Directional derivative, Divergence, Curl, Del applied twice to point functions, Del applied to product of point functions (vector identities). Applications: Irrotational fields and Solenoidal fields.

UNIT-V

Vector Integral Calculus: Line integral, Surface integral and Volume integral. Green's theorem in the plane, verifications of Stroke's theorem (without proof) and Gauss's divergence theorem(without proof).

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11^{th} Reprint, 2010.

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Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw- Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

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20EG C01

ENGLISH
(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Course Objectives: This course will introduce the students:

1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

Course Outcomes: After successful completion of the course the students will be able to:

1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques

UNIT-I Understanding Communication in English:
Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.
Vocabulary &Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT-II Developing Writing Skills I:
Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.
Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT-III Developing Writing Skills II:
Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response
Vocabulary and Grammar: Subject-verb agreement.
Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

UNIT-IV Developing Writing Skills III:
Report writing – Importance, structure, elements of style of formal reports ; Writing a formal report.
Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

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UNIT-V Developing Reading Skills:
The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar: Words often confused; Use of standard abbreviations.

Text Books:
1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP. 1995.

Suggested Readings:
1. Wood F.T, Remedial English Grammar,Macmillan, 2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, Communication Skills. Oxford University Press, 2011.

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Code: 20PY C01

OPTICS AND SEMICONDUCTOR PHYSICS

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block chain Technology))

Instruction	3L/week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of the course is to make the student
1. Understand the fundamentals of wave nature of light
2. Acquire knowledge of lasers, holography and fiber optics
3. Familiarize with quantum mechanics
4. Learn the fundamental concepts of solids

Course Outcomes: At the end of the course, the student will be able to
1. Demonstrate the physical properties of light.
2. Explain characteristic properties of lasers and fiber optics
3. Find the applications of quantum mechanics
4. Classify the solids depending upon electrical conductivity
5. Identify different types of semiconductors

UNIT-I

Wave Optics: Huygens' principle –Superposition of waves –Interference of light by wave front splitting and amplitude splitting–Fresnel's biprism – Interference in thin films in reflected light– Newton's rings– Fraunhofer diffraction from a single slit –Double slit diffraction – Rayleigh criterion for limit of resolution– Concept of N-slits–Diffraction grating and its resolving power.

UNIT-II

Lasers & Holography: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion –Different types of lasers: solid-state lasers: Ruby & Nd:YAG; gas lasers: He-Ne & CO_2; semiconductor laser –Applications of lasers in engineering and medicine. Holography: Principle – Recording and reconstruction–Applications.

Fiber Optics: Introduction –Construction –Principle –Propagation of light through an optical fiber – Numerical aperture and acceptance angle –Step-index and graded-index fibers –Pulse dispersion –Fiber losses–Fiber optic communication system –Applications.

UNIT-III

Principles of Quantum Mechanics: Introduction –Wave nature of particles – de-Broglie hypothesis – Physical significance of ψ –Time-dependent and time-independent Schrodinger equations – Born interpretation – Probability current –Wave packets –Uncertainty principle –Particle in infinite square well potential –Scattering from potential step – Potential barrier and tunneling.

UNIT-IV

Band Theory of Solids: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level –Density of states – Bloch's theorem for particles in a periodic potential – Kronig-Penney model – Classification of solids: metals, semiconductors and insulators.

UNIT-V

Semiconductors: Intrinsic and extrinsic semiconductors –Charge carrier concentration in intrinsic semiconductors –Dependence of Fermi level on carrier concentration and temperature in extrinsic semiconductors (qualitative) –Carrier generation and recombination –Carrier transport: diffusion and drift – P-N junction – Thermistor – Hall effect – LED –Solar cell.

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TEXT BOOKS:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications,2011.

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition,2015.

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20CS C01

PROGRAMMING FOR PROBLEM SOLVING
(Common to all Programs)

Instruction	3 Periods per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of this course are
1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
4. Develop in tuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify and understand the computing environments for scientific and mathematical problems.
2. Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
3. Choose data types and control structures to solve mathematical and scientific problem.
4. Decompose a problem into modules and use functions to implement the modules.
5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
6. Develop applications using file I/O.

UNIT -I
Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.
Introduction to programming: Programming languages and generations, categorization of high-level languages.
Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence, and associativity.

UNIT – II
Introduction to decision control statements: Selective, looping, and nested statements.
Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes, Case study using functions and control statements.

UNIT – III
Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting (Selection and Bubble) algorithms, 2-D arrays, matrix operations.
Strings: Introduction, strings representation, string operations with examples. Case study using arrays.

UNIT – IV
Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, dynamic memory allocation, advantages, and drawbacks of pointers.
Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions, and enumerated data types.

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UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.

Preprocessor Directives: Types of preprocessor directives, examples.

Text Books:

1. M.T. Somashekar “Problem Solving with C”, 2nd Edition, Prentice Hall India Learning Private Limited 2018
2. AK Sharma, “Computer Fundamentals and Programming”, 2nd Edition, University Press, 2018
3. Pradeep Deyand Manas Ghosh, “Programming in C”, Oxford Press, 2nd Edition, 2017

Suggested Reading:

1. Byron Gottfried, Schaum’s Outline of Programming with C”, Mc Graw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Reema Tharaja “Introduction to C Programming”, Second Edition, OXFORDPress,2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm.
2. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

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20MT C02

LINEAR ALGEBRA & CALCULUS LAB

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block chain Technology))

Instruction	2P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To explain basic operations of matrix algebra.
2. To discuss the behavior of the infinite Series.
3. To discuss the maxima and minima of the functions of two variables
4. To discuss Physical interpretations on Scalars and vector functions.
5. To explain vector line, surface and volume integrals.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the Matrix operations in executing various programmes.
2. Test the convergence and divergence of the infinite Series.
3. Explore the extreme values of functions of two variables.
4. Determine the gradient, divergent and curl of scalar and vector point functions.
5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems

LIST OF EXPERIMENTS:

1. Addition and multiplication of higher order matrices.
2. Determinant and Inverse of the matrices
3. Eigen values and Eigenvectors of Matrix.
4. Nature of quadratic form of Matrix.
5. Solution of system of linear equations.
6. Data plotting (2D,3D)
7. Test the convergence of infinite series
8. Examine the extreme values of given function
9. Examine the rotational, irrotational and divergence of the flows
10. Verify inter connection between vector theorems (Green's, Gauss and Stoke's Theorems)

Text Books / Suggested Reading / Online Resources:

1. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
2. https://www.scilab.org/tutorials\
3. https://nptel.ac.in/courses/106102064/
4. https://www.udemy.com/algorithms-and-data-structures-in-python/

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20EG C02

ENGLISH LAB

(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives: This course will introduce the students:

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behavior while developing their ability to discuss in groups and making oral presentations.

Course Outcomes: After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyse IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams ,and discuss and participate in Group discussions.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material
6. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary –** weaving an imaginative story around a given picture.
9. **Information Gap Activity –** Writing a brief report on a newspaper headline by building on the hints given
10. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd 2011
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016

20PY C03

OPTICS AND SEMICONDUCTOR PHYSICS LAB
(CSE, IT, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	4Periods/week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2

Course Objectives: The objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments
2. Understand the behaviour of the light experimentally
3. Analyze the conduction behaviour of semiconductor materials and optoelectronic devices

Course Outcomes: At the end of the course, the student will be able to

1. Interpret the errors in the results of an experiment.
2. Demonstrate physical properties of light experimentally
3. Make use of lasers and optical fibers for engineering applications
4. Explain the V-I characteristics of some optoelectronic and semi conductor devices
5. Find the applications thermistor

Experiments

1.	Error Analysis	:	Estimation of errors in the determination of time period of a torsional pendulum
2.	Fresnel's Biprism	:	Determination of wavelength of given monochromatic source
3.	Newton's Rings	:	Determination of wavelength of given monochromatic source
4.	Single Slit Diffraction	:	Determination of wavelength of given monochromatic source
5.	Diffraction Grating	:	Determination of wavelengths of two yellow lines of light of mercury lamp
6.	Laser	:	Determination of wavelength of given semiconductor laser
7.	Holography	:	Recording and reconstruction of a hologram
8.	Optical Fiber	:	Determination of numerical aperture and power losses of given optical fiber
9.	Energy Gap	:	Determination of energy gap of given semiconductor
10.	P-N Junction Diode	:	Study of V-I characteristics and calculation of resistance of given diode in forward bias and reverse bias
11.	Thermistor	:	Determination of temperature coefficient of resistance of given thermistor
12.	Hall Effect	:	Determination of Hall coefficient, carrier concentration and mobility of charge carriers of given semiconductor specimen
13.	LED	:	Study of I-V characteristics of given LED
14.	Solar Cell	:	Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance
15.	Planck's Constant	:	Determination of Planck's constant using photo cell

NOTE: A minimum of TWELVE experiments should be conducted

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20CS C02

PROGRAMMING FOR PROBLEM SOLVING LAB
(Common to All Programs)

Instruction	4 Periods per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

Course Objectives: The objectives of this course are

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and setup program development environment.
2. Design and test programs to solve mathematical and scientific problems.
3. Identify and rectify the syntax errors and debug program for semantic errors
4. Implement modular programs using functions.
5. Represent data in arrays, pointers, structures and manipulate them through a program.
6. Create, read, and write to and from simple text files.

Lab experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

Text Books:

1. Pradeep Dey and Manas Ghosh, “Programming in C”, Oxford Press, 2nd Edition, 2017.
2. Reema Tharaja “Introduction to C Programming”, Second Edition, OXFORD Press, 2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

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20ME C01

CAD AND DRAFTING

Instruction	1 T + 3 D Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2.5

Course Objectives:

1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

Outcomes: At the end of the course, the Students are able to

1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

List of Exercises:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice versa.

Text Books:

1. N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishers, 2012.
2. K.Venugopal, “Engineering Drawing and Graphics + AutoCAD”, New Age International Pvt. Ltd, 2011.
3. Basanth Agrawal and C M Agrawal, “Engineering Drawing”, 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., “Engineering Drawing”, 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011.

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20MBC02

COMMUNITY ENGAGEMENT

Instruction	3 Hours per week (30 hours field work & 2 hours per week)
SEE	Nil
CIE	50 Marks
Credits	1.5 Credits

Course Objectives: The main Objectives of this Course are to:

1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

Course Outcomes: After the completion of this Course, Student will be able to:

1. Gain an understanding of Rural life, Culture and Social realities.
2. Develop a sense of empathy and bonds of mutuality with Local Communities.
3. Appreciate significant contributions of Local communities to Indian Society and Economy.
4. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
5. Utilise the opportunities provided by Rural Development Programmes.

Module I Appreciation of Rural Society

Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

Module II Understanding Rural Economy and Livelihood

Agriculture, Farming, Landownership, Water management, Animal Husbandry, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III Rural Institutions

Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees, Local Civil Society, Local Administration.

Module IV Rural Development Programmes

History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

Text Books:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

Journals:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).

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20MT C03

DIFFERENTIAL EQUATIONS &TRANSFORM THEORY

(CSE,IT, CSE (AI&ML), AI&DS, CSE (IOT &Cyber Security including Block Chain Technology))

Instruction	3 L per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss the properties of Legendre's Polynomials and Bessel's functions
4. To explain the Z-Transform and InverseZ-Transforms.
5. To discuss Fourier transform for solving engineering problems.

Course Outcomes:

Upon completing this course, students will be able to:

1. Calculate the solutions of first order linear differential equations.
2. Calculate the solutions of higher order linear differential equations.
3. Examine the series solutions for higher order differential equations.
4. Evaluate the Improper integrals by Fourier Transform.
5. Solve the difference equations byZ-transforms.

UNIT - I

Differential Equations of First Order: Exact Differential Equations, Equations Reducible To Exact Equations, Linear Equations, Bernoulli's Equations, Riccati's and Clairaut's Equations, Orthogonal trajectories.

UNIT-II

Higher Order Linear Differential Equations: Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Cauchy's homogeneous linear equation. applications: LR and LCR circuits.

UNIT-III

Series Solutions of Differential Equations: Ordinary point, singular point and regular singular point, Series solution when **x=a** is an ordinary point of the equation. Legendre's equation, Legendre's Polynomial of first kind (without proof), Rodrigue's formula, orthogonality of Legendre polynomials. Bessel's equation, Bessel's function of the first kind of order n (without proof), recurrence formulae for **$J_n(x)$** and related problems (i.e$J_0(x)$, $J_1(x)$, $J_{1/2}(x)$, $J_{-1/2}(x)$, $J_{3/2}(x)$, $J_{-3/2}(x)$).

UNIT-IV

Fourier Transforms: Fourier integral theorem (statement), Complex form of Fourier integrals. Fourier transforms, Inverse Fourier Transforms, Fourier Sine and Cosine transforms, Inverse Fourier Sine and Cosine Transforms. Properties of Fourier transforms: Linear property, change of scale property, shifting property and Modulation theorem.

UNIT-V

Z-Transforms: Definition, some standard Z-transforms, linearity property, damping rule, shifting U_n to the right, shifting U_n to the left, multiplication by 'n', initial and final value theorems. Inverse Z-Transform: evaluation of Inverse Z-transform by Convolution theorem, partial fractions method. Z- Transform application to difference equations.

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Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. R.K.Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.

Suggested Reading:

1. N.P.Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. A.R. Vasishtha, and R.K. Guptha Integral transforms, Krishna Prakashan Media, Reprint, 2016

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20CY C01

CHEMISTRY

(Common to all branches)

Instruction:	3Hours per Week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE	40 Marks
Credits:	3

Course Objectives

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

Course Outcomes

At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

UNIT-I Atomic and molecular structure and Chemical Kinetics:

Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2 , He_2^+ ,N_2 , O_2 , O_2^- , CO, NO). Pi- molecular orbitals of benzene and its aromaticity.

Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction-Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, – Reference electrodes (NHE, SCE)-electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations. Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.

Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel cell.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism -

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Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid)&Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.
Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)
Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)
Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides)
Cyclization (Diels - Alder reaction)

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process),ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V Engineering Materials and Drugs:
Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber). Conducting polymers- Definition, classification and applications.
Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography.
Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle).
Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd.,New Delhi,16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson,Delhi, 7th edition(2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla,Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Readings:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

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20ITC01

DATA STRUCTURES AND ALGORITHMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To introduce representation, specification, and applications of various linear and nonlinear data structures.
2. To familiarize with asymptotic analysis of iterative and recursive functions.
3. To acquaint with various pattern matching algorithms.
4. To present different sorting algorithms.
5. To explain hashing and collision handling.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Analyse time complexity of both iterative and recursive functions.
2. Understand various sorting algorithms and their performance
3. Build optimal solutions using linear and nonlinear data structures.
4. Apply pattern matching.
5. Understand hash functions and collision handling

UNIT-I

Introduction: Data Structures, Abstract Data Types, Algorithm, Analysis of Algorithms, Running Time Analysis, Commonly Used Rates of Growth, Big O Notation, Omega Notation, Theta Notation, Guidelines for Asymptotic Analysis

Recursion: Introduction, Recursion and Memory, Recursion versus Iteration, Example algorithms of Recursion

Sorting: Introduction, Classification of Sorting Algorithms, Selection Sort, Insertion Sort, Merge Sort, Heap Sort, Quick Sort, Radix sort, Comparison of Sorting Algorithms

Searching: Introduction, Types of Searching, Unordered Linear Search, Sorted/Ordered Linear Search, Binary Search

UNIT-II

Linked Lists: Linked List ADT, Comparison of Linked Lists with Arrays and Dynamic Arrays, Singly Linked Lists, Doubly Linked Lists, Circular Linked Lists

Stacks: Stack ADT, Applications, Implementation, Comparison of Implementations, Stacks: Problems & Solutions

UNIT-III

Queues: Queue ADT, Exceptions, Applications, Implementations, Queues: Problems & Solutions

Trees: Introduction, Glossary, Binary Trees, Types of Binary Trees, Properties of Binary Trees, Binary Tree Traversals, Binary Search Trees (BSTs), Balanced Binary Search Trees, AVL Trees: Properties, rotations, insertion

UNIT-IV

Priority Queues and Heaps: Priority Queue *AD*T, Priority Queue Applications, Priority Queue Implementations, Heaps and Binary Heaps, Binary Heaps, Heap Sort

String Algorithms: Introduction, String Matching Algorithm, Brute Force Method, String Matching with Finite Automata, KMP, Tries, Ternary Search Trees, Suffix Trees

UNIT-V

Graph: Introduction, Applications of Graphs, Graph Representation, Graph Traversals, Minimal Spanning Tree

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Hashing: Hash Table ADT, Components of Hashing, Hash Table, Hash Function, Load Factor, Collisions, Collision Resolution Techniques, Separate Chaining, Open Addressing, Comparison of Collision Resolution Techniques, Hashing Techniques, Limitations of Hash Tables.

Text Book:

1. Narasimha Karumanchi, "Data Structures And Algorithmic Thinking With Python", Career Monk Publications, 2016

Suggested Reading:

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structure and Algorithms in Python”, Wiley, 2013.
2. Kenneth A. Lambert, " Fundamentals of Python: Data Structures", Cengage Learning, 2018.
3. Narasimha Karumanchi, “Data Structures and Algorithms for GATE”, Career Monk Publications, 2011.
4. D. Samantha, “Classic Data Structures”, Prentice Hall India, 2ndEdition, 2013.

Web Resources:

1. https://visualgo.net/en
2. https://www.coursera.org/specializations/data-structures-algorithms
3. https://nptel.ac.in/courses/106/106/106106182/
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms
5. https://www.edx.org/course/algorithms-and-data-structures

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20ITC02

OBJECT ORIENTED PROGRAMMING USING PYTHON

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Course Objectives:

1. To describe the principles of Object-Oriented Programming.
2. To familiarize with basics of python programming
3. To explain the usage of OOP concepts to provide solutions
4. To introduce exception handling, and file operations in python
5. To acquaint with tkinter module to develop GUI applications.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the concepts Object-Oriented Programming
2. Make use of Python programming constructs to implement solutions to problems
3. Model the problem using OOP strategies and handle exceptions
4. Make use of files and perform file handling operations.
5. Develop GUI's

UNIT - I

Introduction to Object Oriented Programming (OOP): Computer Programming and Programming Languages, Features of Object Oriented Programming, Merits and Demerits of Object, Applications of Object Oriented Programming, Differences Between Popular Programming Languages

Basics of Python Programming: Features, History, Future, Writing and Executing First Python Program, Literal Constants, Variables and Identifiers, Data Types, Input Operation, Comments, Reserved Words, Indentation, Operators and Expressions, Expressions in Python, Operations on Strings, Other Data Types, Type Conversion

UNIT - II

Decision Control Statements: Introduction to Decision Control Statements, Selection/Conditional Branching Statements, Basic Loop Structures/ Iterative Statements, Nested Loops, The break Statement, The continue Statement, The pass Statement, The else Statement used with Loops

Functions and Modules: Introduction, Function Definition, Function Call, Variable Scope and Lifetime, The return statement, More on Defining Functions, Lambda Functions or Anonymous Functions, Documentation Strings, Good Programming Practices, Recursive Functions, Greatest Common Divisor, Finding Exponents, The Fibonacci Series, Recursion vs Iteration, Modules, Packages in Python, Standard Library modules, Globals(), Locals(), and Reload(), Function Redefinition

UNIT – III

Classes and Objects: Introduction, Classes and Objects, init method, Class variables, and Object variables, Public and Private Data members, calling methods from other methods, built-in class attributes, garbage collection, class methods, static methods.

File Handling: Introduction, File Path, Types of Files, Opening and Closing Files, Reading and Writing Files

UNIT-IV

Inheritance: Introduction, Inheriting classes, Types of Inheritance, Composition or Containership or complex objects, Abstract classes and interfaces.

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Operator Overloading: Introduction, Implementation of Operator Overloading, Reverse Adding, Overriding __getitem__() and __ setitem__() Methods, Overriding the in Operator, Overloading Miscellaneous Functions, Overriding the __call__() method

UNIT-V

Error and Exception Handling: Introduction to errors and exceptions, Handling Exceptions, Multiple Except Blocks, Multiple Exceptions in a Single Block, Except Block Without Exception, The else Clause, Raising Exceptions, Instantiating Exceptions, Handling Exceptions in Invoked Functions, Built-in and User-defined Exceptions, The finally Block, Pre-defined Clean–up Action, Re-raising Exception, Assertions in Python

GUI Programming with tkinter package

Text Book:

1. Reema Thareja "Python Programming: Using Problem Solving Approach" , Oxford University Press, 2019

Suggested Reading:

1. Tony Gaddis, "Starting Out With Python", 3rd edition, Pearson, 2015.
2. Kenneth A. Lambert, " Fundamentals of Python: Data Structures", Cengage Learning, 2018.
3. Alan D. Moore, "Python GUI programming with Tkinter", 2018

Web Resources:

1. https://www.python.org/
2. https://nptel.ac.in/courses/106/106/106106182/
3. https://www.coursera.org/learn/python
4. https://learnpythonthehardway.org/book/

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20MT C04

DIFFERENTIAL EQUATIONS &TRANSFORM THEORY LAB

(CSE, IT, CSE (AI&ML), AI&DS, CSE (IOT & Cyber Security including Block Chain Technology)

Instruction	2P Hours per week
Duration of SEE	3Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss the properties of Legendre's Polynomials and Bessel's functions
4. To explain the Z-Transform and InverseZ-Transforms.
5. To discuss Fourier transform for solving engineering problems.

Course Outcomes:

Upon completing this course, students will be able to:

1. Explore all the possible solutions of first order differential equation.
2. Analyse the solutions of higher order linear differential equations.
3. Examine the series solutions for higher order differential equations.
4. Evaluate the Improper integrals by Fourier Transform.
5. Apply the Z-transform to solve the difference equations.

List of Programmes:

1. Solution of first order liner differential equations.
2. Solution of first order non liner differential equations
3. Geometrical view of Particular integral of higher order differential equations.
4. Simulations of Legendre's differential equations.
5. Geometrical view of Rodrigue's theorem.
6. Simulations of Bessel's first kind solution.
7. Solutions of Bessel's first kind
   (i.e. $J_0(x)$, $J_1(x)$, $J_{1/2}(x)$, $J_{3/2}(x)$, $J_{-1/2}(x)$, $J_{-3/2}(x)$)
8. Waveform generation continuous signals
9. Computation of Fourier Transformations
10. Discrete Cosine Transforms
11. Digitization of continuous functions.

Text Books / Suggested Reading / Online Resources:

1. https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf
2. https://www.scilab.org/tutorials\
3. https://nptel.ac.in/courses/106102064/
4. https://www.udemy.com/algorithms-and-data-structures-in-python/

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20CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	4 Hours per Week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE	50 Marks
Credits:	2

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theorical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes

At the end of the course student will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

Chemistry Lab

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2}& Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

Text Books:

1. J. Mendham and Thomas , "Vogel's text book of quantitative chemical analysis", Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg & A.Gulati,; R. Chand & Co. : New Delhi (2011).

Suggested Readings:

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

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20IT C03 **DATA STRUCTURES AND ALGORITHMS LAB**

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To introduce predefined data structures of Python
2. To introduce Linked Lists and operations
3. To present Stacks, Queues and their applications
4. To familiarise with Sorting Algorithms and Hashing
5. To gain knowledge of Trees, Graphs, Tries and related algorithms

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Make use of predefined data structures of python to process data.
2. Evaluate the performance of Sorting algorithms
3. Demonstrate Arrays, Linked lists, Stacks, Queues, Binary Search Trees, Graphs
4. Make use of Hashing and perform data storing and retrieval
5. Build optimal solutions using linear and nonlinear data structures to real world problems.

List of Programs

1. Demonstrate the usage of predefined data structures of Python: List, Tuple, String, Set, Dictionary.
2. Implementation of recursive and iterative functions.
3. Implement the following sorting algorithms: Selection Sort, Insertion Sort, Merge Sort, Heap Sort, Quick Sort, Radix Sort.
4. Define Single Linked List ADT and perform all standard operations.
5. Define Doubly Linked List ADT and perform all standard operations.
6. Define Stack and Queue ADTs and implement standard operations.
7. Applications of Stacks and Queues.
8. Implementation of Binary Search Tree.
9. Implementation of Graph traversal techniques.
10. Implementation of Hashing.
11. Implementation of Tries.

Text Book:

1. Narasimha Karumanchi, "Data Structures And Algorithmic Thinking With Python", Career Monk Publications, 2016

Suggested Reading:

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structure and Algorithms in Python”, Wiley, 2013.
2. Kenneth A. Lambert, " Fundamentals of Python: Data Structures", Cengage Learning, 2018.
3. Narasimha Karumanchi, “Data Structures and Algorithms for GATE”, Career Monk Publications, 2011.
4. D. Samantha, “Classic Data Structures”, Prentice Hall India, 2ndEdition, 2013.

Web Resources:

1. https://www.geeksforgeeks.org/data-structures/
2. https://www.coursera.org/specializations/data-structures-algorithms
3. https://nptel.ac.in/courses/106/106/106106182/
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms

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20IT C04

OBJECT ORIENTED PROGRAMMING USING PYTHON LAB

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To familiarize with basics of python programming
2. To explain the usage of OOP concepts to provide solutions
3. To acquaint with Functions and Modules
4. To explain exception handling, file operations in python
5. To introduce library modules to develop GUI applications.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Make use of Python programming constructs to implement solutions to problems
2. Model the problem using OOP strategies and handle exceptions
3. Make use of files and perform file handling operations.
4. Develop GUI's
5. Build solutions to real world problems

List of Programs

1. Demonstrate the use of basic data types and operators.
2. Demonstrate the use of control structures.
3. Implementations of Functions, Lambda functions and parameter passing.
4. Demonstrate the usage of predefined Modules.
5. Implementation of classes with attributes and methods.
6. Demonstration of inheritance.
7. Implementation of Overloading.
8. Implementation of file operations
9. Implementation of Exception Handling
10. Building GUIs.

Text Book:

1. Reema Thareja, "Python Programming: Using Problem Solving Approach", Oxford University Press, 2019

Suggested Reading:

1. Tony Gaddis, "Starting Out With Python", 3rd edition, Pearson, 2015.
2. Kenneth A. Lambert, " Fundamentals of Python: Data Structures", Cengage Learning, 2018.
3. Alan D. Moore, "Python GUI programming with Tkinter", 2018

Web Resources:

1. https://www.python.org/
2. https://nptel.ac.in/courses/106/106/106106182/
3. https://www.coursera.org/learn/python
4. https://learnpythonthehardway.org/book/

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20ME C02

WORKSHOP / MANUFACTURING PRACTICE

Instruction	5P Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2.5

Course Objectives:
1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive &team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes: At the end of the course, the students are able to
1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
3. Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
4. Perform various operations in welding, machining and casting processes.
5. Conceptualize and produce simple device/mechanism of their choice.

List of Exercises

CYCLE 1

Exercises in Carpentry
1. To plane the given wooden piece to required size
2. To make a lap joint on the given wooden piece according to the given dimensions.
3. To make a dove tail-joint on the given wooden piece according to the given dimensions.

Exercises in Tin Smithy
1. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
2. To make a scoop.
3. To make a pamphlet box.

Exercises in Fitting
1. To make a perfect rectangular MS flat and to do parallel cuts using Hacksaw
2. To make male and female fitting using MSflats-Assembly1
3. To make male and female fitting using MSflats-Assembly2

Exercises in House Wiring
1. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch, and wiring of one buzzer controlled by a bellpush
2. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket

3. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- way switches.

CYCLE 2

Exercises in Casting

1. Study of Sand casting process and its applications**.**
2. Green sand moulding practice for a single piece pattern
3. Green sand moulding practice for a split pattern with a horizontal core

Exercises in Welding

1. Study of gas welding equipment and process. Identification of flames, making of Butt joint with gas welding.
2. Study of Arc welding process, making Butt joint with DCSP,DCRP
3. Study of Arc welding process, making Lap joint with A.C

Exercises in Machine shop

1. Study of Machine Tools like Lathe, Drilling, Milling and Shaper.
2. Facing, Plain turning and Step turning operations on Lathe machine.
3. Knurling and Taper turning on Lathe machine

Open ended Exercise:

1. Student should produce a component /mechanism by applying the knowledge of any one trade or combination of trades.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I, 2008 and Vol. II, 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata Mc GrawHill House, 2017.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I", Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

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20ME C03

ENGINEERING EXPLORATION
(PRACTICAL)

Instruction	4 P Hours per week
Duration of SEE	Nil
SEE	Nil
CIE	50 Marks
Credits	1.5

Prerequisites: Nil
Course Outcomes: At the end of the course, the students are able to

1. Understand the role of an engineer as a problem solver.
2. Identify multi-disciplinary approaches in solving an engineering problem.
3. Build simple systems using engineering design process.
4. Analyze engineering solutions from ethical and sustainability perspectives.
5. Use basics of engineering project management skills in doing projects.

UNIT- I
Role of Engineers: Introduction, science, engineering, technology, engineer, scientist, role of engineer, various disciplines of engineering, misconception of engineering, expectations for the 21st century engineer and NBA graduate attributes.
Engineering problems and Design: Multidisciplinary facet of design, pair wise comparison chart, introduction to econometrics system, generation of multiple solution, Pugh chart, motor and battery sizing concepts, introduction to PCB design.

UNIT- II
Mechanisms: Basic components of a mechanism, degrees of freedom or mobility of a mechanism, 4-bar chain, crank rocker mechanism, slider crank mechanism, simple robotic arm building.
Platform-based development: Introduction to programming platforms (Arduino) and its essentials, sensors, transducers and actuators and their interfacing with Arduino.

UNIT- III
Data Acquisition and Analysis: Types of data, descriptive statistics techniques as applicable to different types of data, types of graphs and their applicability, usage of tools (MS-Office /Open Office/ Libre Office / Scilab) for descriptive statistics, data acquisition (temperature and humidity) using sensors interfaced with Arduino, exporting acquired data to spreadsheets, and analysis using representation.

UNIT- IV
Process Management: Introduction to Agile practice, significance of team work, importance of communication in engineering profession, project management tools, checklist, timeline, Gantt chart, significance of documentation.

UNIT -V
Engineering Ethics & Sustainability in Engineering: Identifying Engineering as a profession, significance of professional ethics, code of conduct for engineers, identifying ethical dimensions in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas.
Sustainability in Engineering: Introduction, sustainability leadership, life cycle assessment, carbon foot print.

Text Books:

1. Clive L. Dym, Patric Little, Elizabeth J Orwin, "Engineering Design: A project-based introduction", 4th edition, Willey.
2. Matthew Python, "Arduino programming for beginners", Independently published, 2020.
3. Patrick F. Dunn , "Measurement and data Analysis for engineering and science", third edition, 2014.

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4. Andrew Stellman, Jennifer Greene, “Head First Agile: A brain-friendly guide to Agile principles, ideas, and real-world practices”, Kindle Edition.

Suggested Reading:

1. Charles B. Fleddermann, “Engineering ethics”, fourth edition, Prentice Hall, 2012.
2. Rob Lawlor, “Engineering in society”, second edition, Royal academy of engineering.
3. Richard Dodds, Roger Venables, “Engineering for sustainable development: Guiding principles”, The Royal Academy of engineering, 2005.

   Richard S. Paul, “Robot Manipulators: Mathematics, Programming, and Control”, MIT Press.

ENGINEERING EXPLORATION ASSESSMENT SCHEME				
S. No	**Name of the module**	**Work Hours**	**Marks**	**Evaluation**
1	Role of Engineers	4	-	Evaluation - I
2	Engineering Design	16	5	
3	Mechanisms	6	3	
4	Engineering Ethics	2	2	
5	Platform-based Development	16	5	Evaluation - II
6	Data Acquisition and Analysis	6	4	Evaluation-III
7	Project Management	4	4	
8	Sustainability in Engineering	6	2	
9	Course Project Reviews	12	20	Final Evaluation
10	Code of conduct	-	5	
	Total	**72**	**50**	

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20MTC101 **MATHEMATICAL FOUNDATIONS FOR DATA SCIENCE**

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To discuss vector space and sub space.
2. To explain the linear transformation.
3. To discuss about the stochastic process
4. To explain different estimates
5. To discuss the least squares approximation for fitting**.**

Course Outcomes:

Upon completing this course, students will be able to:

1. Identify the Basis and Dimension of vector space.
2. Calculate the Rank and Nullity of linear transformation.
3. Determine the stochastic measures for the process.
4. Infer the estimation of the statistical observations.
5. Analysing appropriate model for the raw data.

UNIT I

General Vector Spaces: Introduction to General Vector Spaces, Subspace of a Vector Space, Linear Independence and Basis, Dimension, Properties of a Matrix, solutions to a non-homogeneous system of linear equations

UNIT II

Linear Transformations: Introduction to Linear Transformations, Kernel and Range of a Linear Transformation, Rank and Nullity, Inverse Linear Transformations, The Matrix of a Linear Transformation, Composition and Inverse Linear Transformations.

UNIT III:

Expectation: Introduction, Moments, Expectation Based on Multiple Random Variables, Transform Methods, Moments and Transforms of Some Distributions (Weibul and Exponential), Computation of Mean Time to Failure. **Stochastic Process:** Classification of Stochastic Processes, the Bernoulli Process, the Poisson Process andthe normal process.

Unit – IV

Concepts of Inference: Point Estimation, Maximum Likelihood Estimation, Confidence Interval Estimation, Hypothesis Testing, Likelihood Ratio Tests; **Inferences for Single Samples:** Inferences on Mean (Large Samples), Inferences on Mean (Small Samples), Inferences on Variance.

Unit – V

The least squares Approximation: The least squares method, The model for simple linear regression, Fitting a line, goodness of fit, Statistical inference with the simple linear regression model, perdition and confidence intervals, Regression diagnostics. Multiple linear regression, The model for multiple linear regression, Goodness of fit, multiple correlation coefficient, Statistical inference for multiple regression, ANOVA tables.

Text Books.

1. Kishor S. Trivedi, Probability and Statistics with Reliability, Queuing, and Computer Science Applications, John Wiley & Sons, 2016:
2. Randall Pruim, Foundations and Applications of Statistics (An Introduction Using R), American Mathematical Society, 2010.
3. Kuldeep Singh, Linear Algebra Step by Step, Oxford University Press,2014.

Reference Books:

1. William M. Mendenhall Terry L. Sincich, STATISTICS for Engineering and the Sciences, SIXTH EDITION, CRC Press Taylor & Francis Group,2016.
2. David.Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

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20ITC101 **ARTIFICIAL INTELLIGENCE**

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To learn basics of AI and concept of Intelligent Agent.
2. To learn the various Searching techniques
3. To learn first order and second order predicate Logic to infer knowledge
4. To learn classical and real world planning approaches
5. To learn uncertainty and probabilistic reasoning models

Course Outcomes:

Upon completing this course, students will be able to:

6. Understand the basics of AI and concept of Intelligent Agent.
7. Compare the Searching techniques
8. Understand and apply the first order and second order predicate Logic to infer the knowledge
9. Analyze classical and real world planning approaches
10. Understand the uncertainty and apply the probabilistic reasoning models

Unit – I

Introduction: AI Definition, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art ; **Intelligent Agents :** Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents; **Solving Problems by Searching:** Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions

Unit - II

Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environments, **Adversarial Search:** Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-of-the-Art Game Programs; Alternative Approaches; **Constraint Satisfaction Problems:** Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs , Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

Unit - III

Logical Agents : Knowledge-Based Agents, the Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic; **First-Order Logic:** Representation Revisited, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic; **Inference in First-Order Logic:** Propositional Vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

Unit - IV

Classical Planning: Definition of Classical Planning, Algorithms for Planning as State-Space Search, Planning Graphs, Other Classical Planning Approaches, Analysis of Planning Approaches; **Planning and Acting in the Real World:** Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multiagent Planning; **Knowledge Representations:** Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information, The Internet Shopping World.

Unit - V

Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use, The Wumpus World Revisited; **Probabilistic Reasoning:** Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient

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Representation of Conditional Distributions, Exact Inference in Bayesian Networks, **Probabilistic Reasoning over Time:** Time and Uncertainty, Inference in Temporal Models, Hidden Markov Models

Text Books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Edition, 4th Edition.

Suggested Reading:

1. Rich, Knight, Nair: "Artificial intelligence", Tata McGraw Hill, Third Edition, 2009.
2. Nilsson, N., "Artificial Intelligence: A New Synthesis", San Francisco, Morgan Kaufmann, 1998.
3. Kulkarni, Parag, Joshi, Prachi , "Artificial Intelligence : Building Intelligent Systems", PHI, 2015.
4. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs19/
2. https://www.coursera.org/learn/ai-for-everyone

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20ITE105 **SOCIAL NETWORK ANALYSIS**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. Describe about the current web development and emergence of social web
2. Design modeling, aggregating and knowledge representation of semantic web
3. Describe Association rule mining algorithms
4. Summarize knowledge on extraction and analyzing of social web
5. To know the application in real time systems.

Course Outcomes:

After successful completion of the course, student will be able to:

1. Understand the basics of social network analysis.
2. Analyze Ontology representation of social network data.
3. Apply supervised and unsupervised algorithms on social networks.
4. Interpret the semantic content of social media data.
5. Build social network model for real time applications.

UNIT-I

INTRODUCTION: Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

UNIT-II

MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION:

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modeling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

UNIT-III

ALGORITHMS AND TECHNIQUES: Association Rule Mining, Supervised Learning, Unsupervised Learning, Semi-supervised Learning, Markov models, K-Nearest Neighboring, Content-based Recommendation, Collaborative Filtering Recommendation, Social Network Analysis, Detecting Community Structure in Networks, the Evolution of Social Networks.

UNIT-IV

EXTRACTING AND ANALYZING WEB SOCIAL NETWORKS: Extracting Evolution of Web Community from a Series of Web Archive, Temporal Analysis on Semantic Graph using Three-Way Tensor, Decomposition, Analysis of Communities and their Evolutions in Dynamic Networks.

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UNIT- V

APPLICATIONS: A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection.

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Text Books:

1. Peter Mika, "Social Networks and the Semantic Web", Springer, 1st edition, 2007.
2. Guandong Xu , Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 1st edition, 2012.
3. Przemyslaw Kazienko, Nitesh Chawla,"Applications of Social Media and Social Network Analysis", Springer,2015.

Suggested Reading:

1. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, "Computational Social Network Analysis: Trends, Tools and Research Advances", Springer, 2012
2. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1 st edition, 2011
3. Charu C. Aggarwal, "Social Network Data Analytics", Springer; 2014
4. Giles, Mark Smith, John Yen, "Advances in Social Network Mining and Analysis", Springer, 2010.

Web Resource:

1. https://swayam.gov.in/nd1_noc19_cs66/preview

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20ITE112 **DIGITAL IMAGE PROCESSING AND ANALYSIS**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To learn the fundamental concepts and applications of digital image processing and analysis, image fundamentals, intensity transformations and spatial filtering
2. To learn basics of frequency domains filtering, image restoration and reconstruction concepts
3. To learn about wavelets and other transformations, basics of colour image processing and various image compression methods
4. To learn morphological image processing concepts and various image segmentation techniques
5. To learn various feature extraction methods and image pattern classification approaches

Course Outcomes:

Upon successful compilation of the course, student will be able to

1. Explain the fundamentals of digital image processing, colour models and intensity transformations
2. Demonstrate smoothing and sharpening in both spatial and frequency domains, image restoration and reconstruction
3. Demonstrate the usage of wavelets and other image transforms
4. Compare image compression methods Huffman Coding, Arithmetic Coding, LZW Coding, Block Transform Coding
5. Recommend proper use of morphological and segmentation algorithms
6. Build an image pattern classification system using feature extraction and image pattern classification techniques

UNIT - I

Introduction and applications; **Digital Image Fundamentals**, Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sampling and Quantization, Basic Concepts in Sampling and Quantization, Some Basic Relationships Between Pixels; **Intensity Transformations and Spatial Filtering**, Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, The Mechanics of Linear Spatial Filtering, Smoothing (Low pass) Spatial Filters, Sharpening (High pass) Spatial Filters;

UNIT - II

Filtering in the Frequency Domain, Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform of Two Variables, Some Properties of the 2-D DFT and IDFT, The Basics of Filtering in the Frequency Domain, Image Smoothing Using Low pass Frequency Domain Filters, Image Sharpening Using High pass Filters; I**mage Restoration and Reconstruction,** A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only—Spatial Filtering, Periodic Noise Reduction Using Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering

UNIT - III

Wavelet and other Image Transforms, Matrix-based Transforms, Correlation, Basis Functions in the Time-Frequency Plane, Basis Images, Fourier-Related Transforms, Walsh-Hadamard Transforms, Slant Transform, Haar Transform, Wavelet Transforms; **Color Image Processing,** Color Fundamentals, Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing; **Image Compressions,** Fundamentals, Huffman Coding, Arithmetic Coding, LZW Coding, Bit-plane Coding, Block Transform Coding

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UNIT - IV

Morphological Image Processing, Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transform, Some Basic Morphological Algorithms, **Image Segmentation,** Fundamentals, Point, Line, and Edge Detection, Thresholding, Segmentation by Region Growing and by Region Splitting and Merging, Region Segmentation Using Clustering and Super pixels, Region Segmentation Using Graph Cuts, Segmentation Using Morphological Watersheds, The Use of Motion in Segmentation

UNIT - V

Feature Extraction, Background, Boundary Preprocessing, Boundary Feature Descriptors, Region Feature Descriptors, Some Basic Descriptors, Principal Components as Feature Descriptors, Whole-Image Features, Scale-Invariant Feature Transform (SIFT); **Image Pattern Classification,** Background, Patterns and Pattern Classes, Pattern Classification by Prototype Matching, Optimum (Bayes) Statistical Classifiers

Text Book:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Pearson Education, Fourth Edition, 2019.

Suggested Reading:

1. Vipula Singh, "Digital Image Processing with MatLab and lab View", Elsevier.
2. Thomas B. Moeslund, "Introduction to Video and Image Processing: Building Real Systems and Applications", Springer, 2012.
3. Milan Sonka, Vaclav Halvac and Roger Boyle, "Image Processing, Analysis, and Machine Vision", Second Edition, Thomson Learning Publishers.
4. Kenneth R.Castleman, "Digital Image Processing", Pearson Education, 2006.

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20MEM103 **RESEARCH METHODOLOGY AND IPR**

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Course Objectives:
To make the students to
1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Course Outcomes:
At the end of the course, student will be able to
1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT - I
Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT - II
Literature Survey Report writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT - III
Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT - IV
Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT - V
Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

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Text Books:

1. C.R Kothari, “Research Methodology, Methods & Technique”; New Age International Publishers, 2004
2. R. Ganesan, “Research Methodology for Engineers”, MJP Publishers, 2011
3. Y.P. Agarwal, “Statistical Methods: Concepts, Application and Computation”, Sterling Publs., Pvt., Ltd., New Delhi, 2004

Suggested Reading:

1. Ajit Parulekar and Sarita D’ Souza, “Indian Patents Law – Legal & Business Implications”; Macmillan India ltd , 2006
2. B. L.Wadehra; “Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications”; Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan; “Law of Copyright and Industrial Designs”; Eastern law House, Delhi 2010

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20EG A101 **ENGLISH FOR RESEARCH PAPER WRITING**

(AUDIT COURSE)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Credits	0

Course Objectives:

1. To understand the nuances of language and vocabulary in writing a Research Paper.
2. To develop the content, structure and format of writing a research paper.
3. To enable the students to produce original research papers without plagiarism.

Course Outcomes:

Upon completing this course, students will be able to:

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. To review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT -I

Academic Writing: Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT- II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT –III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT- IV

Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading.

UNIT- V

Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits

Text Book:

1. C. R Kothari, Gaurav, Garg, **Research Methodology Methods and Techniques,** New Age International Publishers. 4th Edition.

Suggested Reading:

1. Day R (2006) "How to Write and Publish a Scientific Paper**",** Cambridge University Press
2. MLA **"**Hand book for writers of Research Papers**"**, East West Press Pvt. Ltd, New Delhi, 7th Edition.
3. Lauri Rozakis, Schaum's, "Quick Guide to Writing Great Research Papers**"**, Tata McGraw Hills Pvt. Ltd, New Delhi.

Online Resource:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

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20MTC102 **MATHEMATICAL FOUNDATIONS FOR DATA SCIENCE LAB**

Instruction	2 Hours per week
CIE	50 Marks
Credits	1

Course Objectives:

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate R programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in R statistical packages.
6. Manage data using files.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Identify and setup program development environment.
2. Implement the algorithms using R programming language constructs.
3. Identify and rectify the syntax errors and debug program for semantic errors.
4. Solve problems in a statistical approach using functions.
5. Implement file operations.

List of Programs

1. Execution of Eigen values and Eigen vectors
2. Solution of non homogenous system of linear equations
3. Inverse matrix of linear transformation
4. Verification of MTTF for the continuous Distributions.
5. Likely Hood Ratio Test by Hypothesis Testing.
6. F-Test by Hypothesis Testing.
7. Compute the significance level (P value).
8. Linear Predicted Model.
9. Multiple Regression Model.
10. ANOVA for Multiple Regression)

Reference Books:

1. R For Statistics by Cornillon Pierre Andre Et Al , T and F India,January 2015
2. An Introduction to Statistical Learning: with Applications in R,Springer; 2017.R Statistics Cookbook, Francisco Jureting, Packt publishing ltd,2019.

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20ITC104 **ARTIFICIAL INTELLIGENCE LAB**

Instruction	2 Hours per week
CIE	50 Marks
Credits	1

Course Objectives:

1. To familiarize with search and game playing strategies.
2. To introduce logic programming concepts through Prolog.
3. To learn probabilistic reasoning on uncertain data.
4. To learn knowledge representation and inference
5. To learn building AI Systems

Course Outcomes:

Upon completion of this course, students will be able to:

1. Solve AI problems through Python Programming
2. Demonstrate an intelligent agent
3. Evaluate Search algorithms
4. Build knowledge representation system and infer knowledge from it.
5. Apply probabilistic reasoning on data.

List of Programs

1. Implementation of uninformed search techniques.
2. Implementation of informed search techniques.
3. Implementation of game search.
4. Implementation of a program to represent knowledge
5. Implementation of a program to construct a Bayesian network from given data.
6. Implementation of a program to infer from the Bayesian network.
7. Installation of Prolog and demonstration of basic operations.
8. Mini Project work

Text Books:

1. Russell, Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, Third Edition, 2015
2. Allen B. Downey, "Think Python How to Think Like a Computer Scientist", Second Edition, O'Reilly, 2016.

Suggested Reading:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.
2. Rich, Knight, Nair: "Artificial intelligence", Tata McGraw Hill, Third Edition, 2009.
3. Nicole Bauerle, Ulrich Rieder, "Markov Decision Process with Applications to Finance", Springer, 2011.
4. Nilsson. N., "Artificial Intelligence: A New Synthesis", First Edition, Morgan Kaufmann, 1998.
5. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, Delhi.

Web Resources:

1. https://ai.berkeley.edu/project_overview.html
2. http://aima.cs.berkeley.edu/

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1. Algorithm Design, http://ww3.algorithmdesign.net/
2. Advanced Algorithms Material, http://ocw.mit.edu/courses/electrical-engineering-and-computerscience/6-854j-advanced-algorithms-fall-2008/study-materials/

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Instruction	4LHours per week
CIE	50 Marks
Credits	2

Course Objectives:

1. To learn intensity transformations
2. To learn smoothing and sharpening in both spatial and frequency domains, image restoration and reconstruction
3. To learn the usage of wavelets and other image transforms
4. To learn the image compression methods Huffman Coding, Arithmetic Coding, LZW Coding, Block Transform Coding
5. To learn the use of morphological, segmentation algorithms andimage pattern classification

Course Outcomes:

Upon completion of this course, students will be able to:

1. Demonstrate the gray level intensity transformations
2. Demonstrate the smoothing and sharpening operations in both the spatial and frequency domains, image restoration and reconstruction
3. Demonstrate the usage of wavelets and other image transforms
4. Compare image compression methods Huffman Coding, Arithmetic Coding, LZW Coding, Block Transform Coding
5. Evaluate the use of morphological and segmentation algorithms
6. Build an image pattern classification system

List of Programs

1. Implementation of gray level transformations
2. Implementation of histogram equalization algorithms
3. Implementation of smoothing and sharping of an image in spatial domain.
4. Implementation of smoothing and sharping of an image in frequency domain.
5. Implementation of opening and closing of the image.
6. Implementation of morpholphical image processing operations
7. Implementation of edge detection algorithms
8. Implementation of grey level slicing
9. Implementation a program to demonstrate of Noise models
10. Implementation of Segmentation Algorithms
11. Mini Project

Text Book:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson Education, Fourth Edition, 2019.
2. Allen B. Downey, “Think Python How to Think Like a Computer Scientist”, Second Edition, O'Reilly, 2016.
3. Vipula Singh, “Digital Image Processing with MatLab and lab View”, Elsevier.

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20ITC102 **INTRODUCTION TO DATA SCIENCE**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:
1. To introduce the fundamentals of Data Science.
2. To familiarise with Numpy, Pandas and handle large data.
3. To facilitate learning of data pre-processing.
4. To introduce plotting and visualisation.
5. To present grouping and aggregate operations

Course Outcomes:
Upon completing this course, students will be able to:
1. Comprehend the process of Data Science.
2. Understand machine learning and handle large unstructured data.
3. Make use of the packages Numpy, Pandas and interact with Web API and databases.
4. Choose suitable pre-processing techniques to process raw data.
5. Interpret the data from visualisations.
6. Apply appropriate group and aggregation operations.

UNIT-I
Data science in a big data world: Benefits and uses of data science and big data, Facets of data, The data science process, **The data science process:** Overview of the data science process, Don't be a slave to the process, Defining research goals and creating a project charter, Retrieving data, Cleansing, integrating, and transforming data, Exploratory data analysis, Build the models, Presenting findings and building applications on top of them

UNIT-II
Machine learning: machine learning, The modeling process, Types of machine learning, Semi-supervised learning, **Handling large data on a single computer:** The problems you face when handling large data, General techniques for handling large volumes of data, General programming tips for dealing with large data sets, Introduction to NoSQL

UNIT-III
Graph databases: Introducing connected data and graph databases, **Text mining and text analytics:** Text mining in the real world, Text mining techniques. **NumPy Basics:** The NumPy ndarray, Universal Functions: Fast Element-Wise ArrayFunctions, **Getting Started with Pandas:** Introduction to pandas data structures, Essential functionality

UNIT-IV
Data Loading, Storage, and File Formats: Reading and writing data in text format, Binary data formats, Interacting with Web APIs, Interacting with Databases, **Data Cleaning and Preparation:** Handling missing data, Data transformation, **Data Wrangling: Join, Combine, and Reshape**: Hierarchical Indexing, Combining and Merging Datasets, Reshaping: Reshaping with hierarchical indexing

UNIT-V
Plotting and Visualization: Matplotlib primer, Plotting with pandas and seaborn, **Data Aggregation and Group Operations**: GroupBy Mechanics, Data Aggregation, Apply: General split-apply-combine, Pivot Tables and Cross-Tabulation.

Text Books:

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science: Big Data, Machine Learning, and more, using Python Tools", Manning Publications, 2016

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2. William McKinney, "Python for Data Analysis Data Wrangling with Pandas, NumPy and IPython", Second Edition, O'Reilly Media, 2017.

Suggested Reading:

1. Joel Grus, "Data Science from Scratch-First Principles with Python", O'Reilly Media, 2015
2. John V. Guttag, "Introduction to Computation and Programming Using Python– with Application to Understanding Data", Second Edition, The MIT Press, 2016.
3. Alberto Boschetti, Luca Massaron, "Python Data Science Essentials: A Practitioner's Guide Covering Essential Data Science Principles, Tools, and Techniques", Third Edition, 2018.
4. Allen B. Downey, "Think Python How to Think Like a Computer Scientist", Second Edition, O'Reilly, 2016.

Web Resources:

1. https://www.kaggle.com
2. https://www.dataschool.io/
3. https://www.analyticsvidhya.com/blog/2018/05/24-ultimate-data-science-projects-to-boost-your-knowledge-and-skills/
4. https://www.linkedin.com/in/randylaosat

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20ITC103 **MACHINE LEARNING**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:
1. To impart knowledge on the basic concepts underlying machine learning.
2. To acquaint with the process of selecting features for model construction.
3. To familiarize different types of machine learning techniques.
4. To facilitate understanding of neural networks, artificial neural networks and genetic algorithms
5. To provide basic knowledge analytical learning and reinforcement learning.

Course Outcomes:
After successful completion of the course, student will be able to:
1. Understand the concepts of Machine learning and Concept learning
2. Build classification algorithms and artificial neural networks and evaluate the accuracy.
3. Examine the Bayesian classifier and its variants for predicting the probabilities.
4. Design solutions based on optimization using genetic algorithms.
5. Develop search control knowledge by inductive and analytical learning
6. Understand reinforcement learning and choose the best learning mechanism to the problem.

UNIT-I
Introduction: Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning, types of Machine Learning.
Concept learning and the general to specific ordering: Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias.
Decision Tree learning: Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

UNIT-II
Artificial Neural Networks: Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptrons, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition, Advanced topics in artificial neural networks.
Evaluating Hypotheses: Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms.

UNIT-III
Bayesian learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm.
Instance-Based Learning: Introduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

UNIT-IV
Genetic Algorithms: Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms
Analytical Learning: Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge.

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UNIT- V

Combining Inductive and Analytical Learning: Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators

Reinforcement Learning: Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming

Text Books:

1. Tom Mitchel "Machine Learning", Tata McGraW Hill, 2017.
2. Giuseppe Bonaccorso, "Machine Learning Algorithms", 2nd Edition, Packt, 2018,

Suggested Reading:

1. Ethem Alpaydin, "Introduction to Machine Learning", PHI, 2004
2. StephenMarshland, "Machine Learning: An Algorithmic Perspective",CRC PressTaylor & Francis, 2nd Edition, 2015
3. Abhishek Vijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018
4. ReemaThareja "Python Programming", Oxford Press, 2017
5. Yuxi Liu, "Python Machine Learning by Example", 2nd Edition, PACT, 2017

Web Resource:

1. https://nptel.ac.in/courses/106/106/106106139/
2. https://www.geeksforgeeks.org/machine-learning/
3. https://www.guru99.com/machine-learning-tutorial.htm
4. https://www.tutorialspoint.com/machine_learning_with_python/index.htm

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20ITE103 **INFORMATION RETRIEVAL SYSTEMS**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:
1. To familiarize with different Information Retrieval models.
2. To learn query languages for data retrieval.
3. To introduce various methods for efficient retrieval of information.
4. To impart knowledge on text operations.
5. To introduce Parallel and Distributed IR models.

Course Outcomes:
After successful completion of the course, student will be able to:
1. Understand different Information Retrieval models.
2. Evaluate the performance of queries for retrieval of data.
3. Analyze the methods for efficient information retrieval.
4. Perform text operations and build indices.
5. Analyze searching techniques and understand Parallel and Distributed IR models.

UNIT-I
Introduction: Basic concepts, Past, Present and Future of IR, The Retrieval Process.
Modeling: Introduction, A Taxonomy of IR Models, Retrieval: Adhoc and Filtering, A formal characterization of IR Models, Classic Information Retrieval, Alternative Set Theoretic Models, Alternative Algebraic Models, Alternative Probabilistic Models.

UNIT-II
Structured Text Retrieval Models, **Models for Browsing Retrieval Evaluation:** Introduction, Retrieval Performance Evaluation, Reference Collections **Query languages:** Introduction, Keyword-based querying, pattern Matching, Structural Queries, Query Protocols

UNIT-III
Query operations: Introduction, User Relevance Feedback, Automatic Local Analysis, Automatic Global Analysis
Text and Multimedia Languages and Properties: Introduction, Metadata, Text, Markup Languages, Multimedia

UNIT-IV
Text Operations: Introduction, Document Preprocessing, Document Clustering, Text Compression, Comparing Text Compression Techniques **Indexing:** Introduction, Inverted Files, Other Indices for Text, Boolean Queries

UNIT- V
Searching: Sequential Searching, Pattern Matching, Structural Queries, Compression
Parallel and Distributed IR: Introduction, Parallel IR, Distributed IR.

Text Book:

1. Ricardo, Baeza-yates, BerthierRibeiro-Neto, “Modern Information Retrieval”, Pearson Education, 2008.

Suggested Reading:

1. Christopher D. Manning, PrabhakarRaghavan, HinrichSchütze, “Introduction to Information Retrieval”, Cambridge University Press, 2009.
2. David A. Grossman, OphirFrieder, "Information Retrieval - Algorithms and Heuristics", Springer, 2nd Edition, 2004.
3. Gerald Kowalski, “Information Retrieval Systems: Theory and Implementation”, Springer.

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4. William B. Frakes, Ricardo Baeza- Yates, "Information Retrieval – Data Structures & Algorithms", Pearson Education, 2008.

Web Resources:

1. https://class.coursera.org/nlp/lecture
2. http://www.dcs.gla.ac.uk/Keith/Preface.html

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20ITE119 **DEEP LEARNING**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:
1. To introduce the concepts, architecture and limitations of neural networks
2. To provide foundational concepts of deep learning.
3. To learn the concepts convolution neural networks.
4. To familiarize with architectures of recurrent neural networks.
5. To impart the knowledge of advanced applications of deep neural networks.

Course Outcomes:
After successful completion of the course, student will be able to:
1. Illustrate the working principle of neural networks, deep learning and their challenges.
2. Understand training of deep feed forward network and Partially Observable Markov Decision Process.
3. Identify the challenges in Neural Network optimization and apply Convolution Neural Network.
4. Analyze the usage of Recurrent Neural Networks for sequential analysis.
5. Implement deep learning algorithms for real-world problems and evaluate their performance.

UNIT-I
The Neural Network (Deep Learning): Neurons, Linear Perceptron as Neuron, Neural Nets Architecture/ Design, Working of Neural Nets, Layers of Neural Networks and Deep learning, Activation Functions, Feed Forward Neural Networks, Limitations of Neurons, Deep Belief Networks (DBNs), Large Scale DBNs, Large Scale Convolution Neural Networks, Deep Learning for Big Data, Deep Learning from High Volumes of Data, Deep Learning from High Variety of Data, Deep Learning for High Velocity of Data, Local Minima in Deep Networks, Rearranging Neurons in a layer of a Neural Network, Spurious Local Minima in Deep Networks.

UNIT-II
Deep Feed forward Networks: Training Neurons, Common terminologies, Flowchart for Training a Deep Learning Model, Avoiding Over fitting in Deep Neural Networks, Deep Reinforcement Learning, Explore versus Exploit, Policy versus Value Learning, Q-Learning and Deep Q-Networks, POMDPS(Partially Observable Markov Decision Process), Applications of POMDPS.

UNIT-III
Deep Learning Optimization: Learning versus Pure Optimization, Challenges in Neural Network Optimization, Basic Optimization Algorithms, Parameter Initializations, Meta-algorithms, **Convolution Neural Networks:** Convolution, The Convolution Layer, The Convolution Operation, Max Pooling, Various Convolution Network Architectures.

UNIT-IV
Sequence Analysis: Variable –sized Inputs Analysis, Beam Search, Stateful Deep Learning Models, Recurrent Neural Networks (RNN), Bidirectional RNNs, Deep Recurrent Networks, Augmenting Recurrent Networks, Neural Turing Machines, Applications of Deep Learning.

UNIT- V
Deep Learning Survey: Representation Learning, Transfer Learning, Exponential Gains from Depth, Challenges of Unstructured Modeling, Using Graphs to explain Model Structure, Sampling, Advantages of Structured Modeling, Deep Learning Approach to Structured Probabilistic Models, Deep Boltzmann Machines, Directed Generative Nets, Generative Stochastic Networks.

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Text Books:

1. Rajiv Chopra, “Deep Learning A Practical Approach (using python)”, 2nd edition, Khanna Book Publishing Co., New Delhi, 2020.

Suggested Reading:

1. Anurag Bhardwaj, Wei Di, Jianing Wei,“Deep Learning Essentials”, Packt Publishing, 2018.
2. Goodfellow, I., Bengio,Y., and Courville, A., “Deep Learning”, MIT Press, 2016.
3. Raúl Rojas , “Neural Networks: Asystematic Introduction”, 1996.
4. Chirstopher Bishop, “Pattern Recognition and machine Learning”, Springer, 2007.

Web Resources:

1. NPTEL Deep Learning Part-1, https://nptel.ac.in/courses/106/106/106106184/#
2. Coursera Deep Learning Specialization course, https://www.coursera.org/specializations/deep-learning

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20EC A101 **VALUE EDUCATION**
(AUDIT COURSE)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Credits	0

Course Objectives:
1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Course outcomes:
Upon completing this course, students will be able to:
1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT I
Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT II
Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT III
Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT IV
Values in Holy Books : Self-management and Good health; **and internal & external Cleanliness,** Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT V
Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasicgunas.

Suggested Reading:
1. Chakroborty, S.K. “Values & Ethics for organizations Theory and practice”, Oxford University Press, New Delhi, 1998.
2. Jaya Dayal Goyandaka, “Srimad Bhagavad Gita”, with Sanskrit Text, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.

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20ITC105 **INTRODUCTION TO DATA SCIENCE LAB**

Instruction	2 Hours per week
CIE	50 Marks
Credits	1

Course Objectives:
1. To introduce data structures in Python.
2. To familiarise with data types and file formats.
3. To gain knowledge on data pre processing and data visualization.
4. To acquaint with supervised and unsupervised learning algorithms.
5. To explore various case studies.

Course Outcomes:
Upon completing this course, students will be able to:
1. Identify appropriate data structures for storing and processing the data.
2. Choose suitable data type to handle real time data and explain file formats.
3. Apply pre processing techniques on raw data
4. Interpret the data from visualisations.
5. Build supervised and unsupervised models to solve real world problems.

List of Programs
1. Implementation of Python programs using Functions, Conditionals, Recursion, Iteration, Strings.
2. Demonstrate the usage of Python data structures. (List, Tuples, Sets, Dictionaries, Strings)
3. Explore various kinds of data like time series, text, etc.
4. Implement file handling operations in Python for various file formats.
5. Implementation of pre processing techniques on any two datasets.
6. Visualise data using packages matplotlib, seaborn, etc., and provide your inference.
7. Build Classifiers and perform prediction.
8. Demonstrate various Clustering Techniques.
9. Predict the price of a house (Boston Housing Dataset).

Text Books:
1. Allen B. Downey, "Think Python How to Think Like a Computer Scientist", Second Edition, O'Reilly, 2016.
2. William McKinney, "Python for Data Analysis Data Wrangling with Pandas, NumPy, and IPython", Second Edition, O'Reilly Media, 2017.
3. Samir Madhavan, "Mastering Python for Data Science", Packt Publishing, 2015.

Suggested Reading:
1. Joel Grus, "Data Science from Scratch-First Principles with Python", O'Reilly Media, 2015.
2. Rachel Schutt, Cathy O'Neil, "Doing Data Science, Straight Talk from the Frontline", O'Reilly, 2014.

Datasets:
1. https://www.kaggle.com/datasets
2. https://www.csie.ntu.edu.tw/~cjlin/libsvmtools/datasets/multilabel.html#siam-competition2007
3. https://archive.ics.uci.edu/ml/index.php

Web Resources:
1. https://www.analyticsvidhya.com/blog/2018/05/24-ultimate-data-science-projects-to-boost-your-knowledge-and-skills/
2. https://www.learndatasci.com/tutorials/data-science-statistics-using-python/
3. https://www.kaggle.com/getting-started
4. https://www.datacamp.com/community/tutorials

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20ITC106 **MACHINE LEARNING LAB**

Instruction	2 Hours per week
CIE	50 Marks
Credits	1

Course Objectives:
1. To impart knowledge on the basic concepts underlying machine learning.
2. To acquaint with the process of selecting features for model construction.
3. To familiarize different types of machine learning techniques.
4. To facilitate understanding of neural networks, artificial neural networks and genetic algorithms
5. To provide basic knowledge analytical learning and reinforcement learning.

Course Outcomes:
After successful completion of the course, student will be able to:
1. Build classification algorithms and artificial neural networks and evaluate the accuracy.
2. Examine the Bayesian classifier and its variants for predicting the probabilities.
3. Design solutions based on optimization using genetic algorithms.
4. Implement k-means, k-nearest and SVM algorithms.
5. Understand reinforcement learning and choose the best learning mechanism to the problem.

List of Programs

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples of .csv file.
2. For a given set of training data examples stored in a .csv file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation Algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .csv file. Compute the accuracy of the classifier, considering few test data sets.
6. Design genetic algorithm which reflects the process of natural selection where the fittest individuals are selected for reproduction in order to produce offspring of the next generation.
7. Demonstrate SVM algorithm used for character recognition task.
8. Apply EM algorithm to cluster a set of data stored in a .csv file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for the experiment and draw graphs.

Text Books:

1. Tom Mitchel “Machine Learning”, Tata McGraW Hill, 2017.
2. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2nd Edition, Packt, 2018,

Suggested Reading:

1. Ethem Alpaydin, “Introduction to Machine Learning”, PHI, 2004
2. StephenMarshland, “Machine Learning: An Algorithmic Perspective”,CRC PressTaylor & Francis, 2nd Edition, 2015
3. Abhishek Vijavargia “Machine Learning using Python”, BPB Publications, 1st Edition, 2018
4. ReemaThareja “Python Programming”, Oxford Press, 2017
5. Yuxi Liu, “Python Machine Learning by Example”, 2nd Edition, PACT, 2017

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Datasets:

1. https://www.kaggle.com/datasets
2. https://www.csie.ntu.edu.tw/~cjlin/libsvmtools/datasets/multilabel.html#siam-competition2007
3. https://archive.ics.uci.edu/ml/index.php

Web Resource:

1. https://nptel.ac.in/courses/106/106/106106139/
2. https://towardsdatascience.com/introduction-to-genetic-algorithms-including-example-code-e396e98d8bf3
3. https://www.geeksforgeeks.org/machine-learning/
4. https://www.guru99.com/machine-learning-tutorial.htm
5. https://www.tutorialspoint.com/machine_learning_with_python/index.htm

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20ITE129 **DEEP LEARNING LAB**

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Objectives:
The objectives of this course are
1. To learn integration of deep learning system with realistic environment through the use of third-party libraries.
2. To impart the capability of applying Deep Learning algorithms and perform experiments on real-world data.
3. To improve the knowledge of Deep Learning techniques in technological and industrial environments.

Course Outcomes:
After successful completion of the course, student will be able to:
1. Understand the concepts of feed forward and backward Neural Networks.
2. Build deep learning models using libraries such as Tensor Flow, Keras and interpret the results.
3. Understand the significance of regularization methods and apply them in training deep neural networks.
4. Build Convolution Neural Networks on applications such as image classification.
5. Implement Recurrent Neural Networks based on the application requirement.

List of Programs
1. Demonstrate normalization of input data, basic activation functions such as the softmax, sigmoid, dsigmoid, etc.
2. Build a neural network for logistic regression to minimize the cost function and update the parameters.
3. Implement backward propagation neural network for a two class classification with a single hidden layer, non-linear activation function like tanh and compute the cross entropy loss.
4. Build a deep neural network with more than one hidden layer, non-linear functions like ReLU.
5. Build deep neural network to any classification problem and compare its accuracy to logistic regression.
6. Apply Regularization techniques in deep learning model with backward propagation.
7. Implement mini batch optimization technique to improve the performance of deep learning model.
8. Demonstrate Convolutional Neural Network with various Convolution functions and Pooling functions.
9. Develop a Residual Network for image classification.
10. Build a bidirectional Recurrent Neural Network for any one application.

Text Books:
1. Goodfellow, I., Bengio,Y., and Courville, A., “Deep Learning”, MIT Press, 2016.

Suggested Reading:
1. Anurag Bhardwaj, Wei Di, Jianing Wei,“Deep Learning Essentials”, Packt Publishing, 2018.
2. Raúl Rojas , “Neural Networks: Asystematic Introduction”, 1996.
3. Chirstopher Bishop, “Pattern Recognition and machine Learning”, Springer, 2007.

Datasets:
1. https://www.kaggle.com/datasets
2. https://www.csie.ntu.edu.tw/~cjlin/libsvmtools/datasets/multilabel.html#siam-competition2007
3. https://archive.ics.uci.edu/ml/index.php

Web Resources:
1. NPTEL Deep Learning Part-1, https://nptel.ac.in/courses/106/106/106106184/#
2. Coursera Deep Learning Specialization course, https://www.coursera.org/specializations/deep-learning

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20ITC107 **MINI PROJECT WITH SEMINAR**

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Outcomes:

Upon completing this course, students will be able to:

1. Formulate a specific problem and give solution.
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions.
4. Conclude the results obtained.
5. Write the documentation in standard format.

Guidelines:

- As part of the curriculum in the II- semester of the programme each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
- Each student will be allotted to a faculty supervisor for mentoring.
- Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
- Mini projects shall have inter disciplinary/ industry relevance.
- The students can select a mathematical modelling based/Experimental investigations or Numerical modelling.
- All the investigations are clearly stated and documented with the reasons/explanations.
- The mini-project shall contain a clear statement of the research objectives, background of the work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and references.

Department Review Committee: Supervisor and Two Faculty Coordinators

Guidelines for awarding marks (CIE):		**Max. Marks: 50**
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

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19IT E107

INTRUSION DETECTION

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce basic concepts of intrusion detection and prevention.
2. To familiarise with Network and Host based IDS.
3. To acquaint with TCP dump and IP header.
4. To facilitate learning of session fixation, Honeypots and Honeynets.
5. To impart knowledge about architectural and organisationl issues.

Course Outcomes: Upon completing this course, students will be able to:

1. Enumerate common pitfalls in the creation and evaluation of new Intrusion Detection Systems.
2. Comprehend Intrusion Detection principles and approaches in order to improve the security posture of an enterprise.
3. Understand TCP dump and examine IP header.
4. Examine network traffic to identify threats that generate unusual traffic flows.
5. Implement models to monitor the security of the system.

UNIT-I

Intrusion Detection and Prevention Principles: Uses of IDPS Technologies, Key Functions of IDPS Technologies, Common Detection Methodologies, Types of IDPS Technologies.

Other Detection Approaches: Misuse detection(Pattern Matching, Rule based Techniques, State based Techniques, Techniques based on Data Mining), Anomaly Detection (Advanced Statistical Models, Rule based techniques, Biological Models, Learning Models) Specification based Detection , Hybrid Detection.

IDPS Technologies: Components and Architecture, Security Capabilities, Management.

UNIT-II

Network based IDPS: Networking Overview, Components and architecture.

Host-Based IDPS: Components and architecture.

Wireless IDPS: Wireless networking overview, components and architecture, capabilities, management.
Network Behavior Analysis System: Components and architecture, security capabilities, management.

UNIT-III
Introduction to TCP Dump and TCP: TCP Dump, Introduction to TCP, TCP Gone awry.
Fragmentation: Theory of Fragmentation, Malicious Fragmentation.
Automated and Manual Response: Automated Response, Honey Pot, Manual Response.
Examining IP Header Field: Insertion and Evasion Attacks, IP Header Fields, MF Flag.

UNIT-IV
Session Fixation: Session Fixation Attack Process, Session Fixation Process Tree, Session Fixation Countermeasures, Session Fixation vs. Session Hijacking.
Honeypots and Honeynets: Introduction, Architecture of Honeypot, Physical vs Virtual Honeypots, Honeypot vs Honeynet.
Business Case for Intrusion Detection: Management Issues, Threats and Vulnerabilities.

UNIT-V
Architectural Issues: Events of Interest, Limits to Observation, Human Factors Limit Detects, Severity, Countermeasures, Calculating Severity, Sensor Placement and outside firewall.
Organizational issues: Defining Risk, Threat and Risk management.
Unified Threat Management: Introduction, Different Inspection Methods and their Benefits, High Level Diagram of UTM.

Text Books:

1. Karen Scarfone, Peter Mell, "Guide to Intrusion Detection and Prevention System (IDPS) National Institute of Standards and Technology", Technology Administration, U.S. Department of Commerce, First Edition, 2007.
2. Stephen Northcutt, Judy Novak, "Network Intrusion Detection", Third Edition, New riders.

Suggested Reading:

1. Peter Szor, "The Art of Computer Virus Research and Defense", Symantec Press
2. Markus Jakobsson and Zulfikar Ramzan, "Crime ware, Understanding New Attacks and Defenses", Symantec Press, 2008.

19CS O101

BUSINESS ANALYTICS

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Course Objectives:

1. Understanding the basic concepts of business analytics and applications
2. Study various business analytics methods including predictive, prescriptive and prescriptive analytics
3. Prepare the students to model business data using various data mining, decision making methods

Course Outcomes: Upon completing this course, students will be able to:

1. To understand the basic concepts of business analytics
2. Identify the application of business analytics and use tools to analyze business data
3. Become familiar with various metrics, measures used in business analytics
4. Illustrate various descriptive, predictive and prescriptive methods and techniques
5. Model the business data using various business analytical methods and techniques

UNIT-I

Introduction to Business Analytics: Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

UNIT-II

Descriptive Analytics: Introduction, data types and scales, types of measurement scales, population and samples, measures of central tendency, percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization

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UNIT-III

Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil's coefficient

UNIT-IV

Decision Trees: CHAID, Classification and Regression tree, splitting criteria, Ensemble and method and random forest. **Clustering**: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, **Prescriptive Analytics**- Linear Programming(LP) and LP model building,

UNIT-V

Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process, cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox

Text Books:

1. U Dinesh Kumar, "Data Analytics", Wiley Publications, 1st Edition, 2017
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications with SAS", Associate Publishers, 2015

Suggested Reading:

1. S. Christian Albright, Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", 5th Edition, Cengage, 2015

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview
2. https://nptel.ac.in/courses/110105089/

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19IT C107

DISSERTATION PHASE-I

Instruction	20 Hours per week
CIE	100 Marks
Credits	10

Course Outcomes: At the end of the course:

1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, national/ international refereed journals and contact resource persons for the selected topic of research.
3. Students will learn to write technical reports.
4. Students will develop oral and written communication skills to present.
5. Student will defend their work in front of technically qualified audience.

Guidelines:

- The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.
- Seminar should be based on the area in which the candidate has undertaken the dissertation work.
- The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.
- The preliminary results (if available) of the problem may also be discussed in the report.
- The work has to be presented in front of the committee consists of Head, Chairperson-BoS, Supervisor and Project coordinator.
- The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

Guidelines for the award of Marks: Max. Marks: 100

Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

Note : Department committee has to assess the progress of the student for every two weeks.

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SCHEME OF INSTRUCTION AND SYLLABI (R-20)

OF

B.E. I & II SEMESTERS

IN

ELECTRICAL & ELECTRONICS ENGINEERING

(For the batch admitted in 2020-21)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)
Affiliated to Osmania University
Kokapet Village, Gandipet Mandal, Hyderabad- 500 075. Telangana
E-Mail: principal@cbit.ac.in; Website: www.cbit.ac.in; Phone Nos.: 040-24193276 / 277 / 279

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Dept. of EEE, CBIT (A)
Gandipet, Hyderabad - 75

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(AUTONOMOUS)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

INSTITUTE VISION AND MISSION:

Vision:
To be centre of excellence in technical education and research

Mission:
To address the emerging needs through quality technical education and advanced research

DEPARTMENT VISION AND MISSION:

Vision:

To achieve Academic and Professional Excellence in Teaching and Research in the frontier areas of Electrical and Electronics Engineering Vis-a -Vis serve as a Valuable Resource for Industry and Society.

Mission:

Empowering the Faculty and Student Rendezvous to Nurture Interest for Conceptual Keystone, Applied Multidisciplinary Research, Inspiring Leadership and Efficacious Entrepreneurship culture , Impeccable Innovation in frontier areas to be synergetic with Environmental, Societal and Technological Developments of the National and International community for Universal Intimacy.

M1: Emphasis on providing Strong Theoretical Foundation & Engineering Leadership Eminence, infusion of Creativity and Management skill while maintaining Ethics and Moral for Sustainable Development. **(Individual development**)

M2: Enable the Faculty and Student Interactions to trigger interest for Applied Multidisciplinary Research and Entrepreneurship Culture resulting in Significant Advancement of the field of Specialization with Involvement of Industries and Collaborative Educational Networks. **(Sense of Ownership, Networking and Eco system Development)**

M3: Extend the Conducive Neighborhoods for Innovation in frontier areas to keep pace with Environmental, Societal and Technological Developments of the National and International Community to Serve Humanity. **(Service to Society, Atmanirbhar Bharat)**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS):

- **PEO1-** Graduates will Ennoble in offering Design solutions for Complex Engineering Problems using appropriate modern Software tools, with the specified need of the Industry and Protagonist in transforming the Society into a Knowledge Society.

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- ❖ **PEO2-** Graduates will Elevate Engineering Leadership and will be recognized as Experts working in Government, Consulting firms, International organizations with their Creativity in Design of Experiments, Analysis and Interpretation of Data and Synthesis of Information.

- ❖ **PEO 3-** Graduates will Exalt in their Professional career by Persistence in Team work, Ethical behavior, Proactive involvement, and Effective Communication.

- ❖ **PEO 4-** Graduate will Excel by becoming Researches, Professors and Entrepreneurs who will create and Disseminate new knowledge in the frontier areas of Engineering, Technology and Management

PROGRAM OUTCOMES (POs):

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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12. **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOS):

PSO 1: Evaluate complex Engineering Problems to meet the distinct need of Industry & Society, by utilizing knowledge of Mathematics, Science, Emerging Technologies such as AI, Block chain & IT tools.

PSO 2: Exhibit Latent talent in understanding the Engineering and Administration standards at work place as a team leader to manage Projects in the Multi-Disciplinary Environments.

PSO 3: Establish Engineering Expertise in Power system, Machines and Drives Systems and also Pursue Research in the Frontier areas such as Embedded systems, Renewable Energy, E-Mobility and Smart grid.

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ABOUT THE DEPARTMENT:

The EEE Department at CBIT operates with one eye on Excellence and the other one on the Future. This is because we know just how fast the world is changing. As such, our students are armed with not only with the traditional knowledge and wisdom in the field of electrical engineering, but also with an interdisciplinary perspective that helps them work in tandem with other specializations in the world of technology and science.

The department of EEE bestowed with Elite students, Eminent Staff and Efficacious Infrastructure is endeavouring the synergy with Research, Innovation and Education Eco system. In order to meet the target the department

(i) heed its Alumni to transfer their expertise to their juniors**; [ALTEREGO]**

(ii) takes the students to Industrial visits for a practical exposure**; [VIKASA]**

(iii) conducts annual technical fest '**ELECTRET**' under 'SUDHEE' banner in order to create a platform to manifest technical skills and leadership qualities;

(iv) arranges Guest Lectures by Industry experts to complement the class room Instruction;

(v) organizes Conferences, Seminars & workshops to bring out the latent talent in the students;

(vi) showcases the achievements of students and staff in order to boast their confidence levels.

As the Head of the Department, I have a vision to carve a niche in the Power and Electronics arena so that the department stands out and most of the students get motivated towards having start-ups of their own.

In order to achieve the vision, the set mission is to amplify the Industry- Institute Interaction in manifold. In this direction, the department entered into an MoU with Industries such as M/s EesaVyasa Technologies Private Limited ; Interleaved Multi disciplinary Research Centre; CARES-Renewable-Coimbatore; HIEE; In this regard, the department has also launched **VIKASA** (**VI**dyuth **KA**rmagara **SA**mmelanam) to create an avenue for the students to get placements in the core sector and become self-reliant as well (Swayam Tejaswin Bhava).

My wish is that our department should be looked up to as a **ROLE MODEL – sculptor** and get International recognition in training Engineering students as **Industry-Ready Ethical Professional Engineers** of our nation. Though the existing qualified staff and well-equipped labs are assets to the department, a lot more is required to achieve the set vision of the department and college.

There is a dire need to coherently work with Premier Institutes and Industries.

Sincerity in implementing an effective **Teaching-Learning Process** blended with **Morals** is one of the top reasons for parents and student aspirants to opt for the EEE department of the prestigious CBIT.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of I Semester of B.E. – Electrical & Electronics Engineering as per AICTE Model Curriculum 2020-21

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20MT C05	Calculus	3	1	-	3	40	60	4
2	20CYC01	Chemistry	3	-	-	3	40	60	3
3	20CE C01	Engineering Mechanics-I	3	-	-	3	40	60	3
4	20CS C01	Programming for Problem Solving	3	-	-	3	40	60	3
PRACTICAL									
5	20CY C02	Chemistry Lab	-	-	4	3	50	50	2
6	20CS C02	Programming for Problem Solving Lab	-	-	4	3	50	50	2
7	20ME C02	Workshop/ Manufacturing Practice	-	-	5	3	50	50	2.5
8	20ME C03	Engineering Exploration	90 Hours / 4P			-	50	-	1.5
TOTAL			**12**	**1**	**13**	**-**	**360**	**390**	**21**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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with effect from the Academic Year 2020-21

20MT C05

CALCULUS
(Common to ECE, EEE, MECH, CHEM, CIVIL)

Instruction	3 L+1T /2P Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives:
1. To explain the solutions of system of linear equations by Matrix Methods.
2. To discuss mean value theorems.
3. To explain the Partial Derivatives and the extreme values of functions of two variables.
4. To discuss the convergence and divergence of the series.
5. To explain the expansion of functions in sine and cosine series.

Course Outcomes:
Upon completing this course, students will be able to:
1. Apply the Matrix Methods to solve system of linear equations.
2. Analyse the geometrical interpretation of Mean value theorems.
3. Determine the extreme values of functions of two variables.
4. Examine the convergence and divergence of infinite Series.
5. Calculate the Euler's coefficients for Fourier series of a function.

UNIT-I
Matrices: Rank of a matrix, Echelon form, consistency of linear system of equations, Linear dependence and independence of vectors. Eigen values, Eigenvectors, Properties of Eigen values& Eigen vectors, Cayley-Hamilton theorem, Quadratic form, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-II
Calculus: Rolle's Theorem, Lagrange's Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, Radius of curvature, Centre of curvature, Evolute and Involute.

UNIT-III
Multivariable Calculus (Differentiation): Functions of two variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions , Change of variables, Jacobians, Taylor's theorem for functions of two variables, Maxima and minima of functions of two variables.

UNIT-IV
Sequences and Series: Convergence of sequence and series. Tests for convergence of series: Comparison test, limit comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, alternating series, Leibnitz's series, absolute and conditional convergence.

UNIT-V
Fourier series: Periodic functions, Euler' formulae**,** Conditions for a Fourier expansion, functions having points of discontinuity, change of interval, even and odd functions, half range sine series, half range cosine series, and its applications in practical Harmonic analysis.

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. B.V.Ramana., Higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw- Hill, New Delhi, 2008.
2. R.K.Jain, S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. David.Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

20CY C01

CHEMISTRY
(Common to all branches)

Instruction:	3Hours per Week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	3

Course Objectives

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

Course Outcomes
At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

UNIT-I Atomic and molecular structure and Chemical Kinetics:
Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method.Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2 , He^+ ,N_2 , O_2 , O_2^- , CO, NO). Pi- molecular orbitals of benzene and its aromaticity.
Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction-Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II Use of free energy in chemical equilibria
Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity).Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, – Reference electrodes (NHE, SCE)-electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations.Numericals.
Battery technology: Rechargeable batteries & Fuel cells.
Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.
Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel cell.

UNIT- III Stereochemistry and Organic reactions
Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism - Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid) & Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.
Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)

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Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)
Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides)
Cyclization (Diels - Alder reaction)

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process),ion exchange method and Reverse Osmosis.Specifications of potable water & industrial water.Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V Engineering Materials and Drugs:
Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber).Conducting polymers- Definition, classification and applications.
Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography.
Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation-Sol-gel method. Carbon nanotubes and their applications.Characterisation of nanomaterials by SEM and TEM (only Principle).
Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition (2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla, Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Readings:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

20CE C01

ENGINEERING MECHANICS – I

Instruction:	3 L Hours per week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits:	3

Course Outcomes: At the end of the course the student will be able to
1. Calculate the components and resultant of coplanar forces system.
2. Understand free body diagram and apply equilibrium equations to solve for unknown forces.
3. Apply concepts of friction for solving engineering problems.
4. Analyse simple trusses for forces in various members of a truss.
5. Determine centroid for elementary, composite figures and bodies.

UNIT- I:
Resolution and Resultant of Force System: Basic concepts of a force system. Components of forces in a plane. Resultant of coplanar concurrent force system. Moment of a force, couple and their applications. Resultant of coplanar non-concurrent force system.

UNIT - II:
Equilibrium of Force System: Free body diagram, equations of equilibrium. Lami's theorem, equilibrium of coplanar force systems.

UNIT - III:
Friction: Theory of static friction, Laws of friction, applications to single body, connected systems, wedge friction and belt friction.

UNIT - IV:
Analysis of Simple Trusses: Introduction to trusses, analysis of simple trusses using method of joints and method of sections.

UNIT - V:
Centroid and Centre of Gravity:
Centroid of lines and areas from first principles, centroid of composite figures, theorems of Pappus, centre of gravity of bodies and composite bodies.

Text Books:
1. K. Vijaya Kumar Reddy and J. Suresh Kumar, "*Singer's Engineering Mechanics: Statics and Dynamics*", B. S. Publications (SI Units), 3rd edn. Rpt., 2019.
2. A. Nelson., "*Engineering Mechanics*", Tata McGraw Hill, Delhi, 2010.

Suggested Reading:
1. Irving H. Shames, *"Engineering Mechanics",* 4th Edition, Prentice Hall, 2006.
2. R. C. Hibbeler, *"Engineering Mechanics: Principles of Statics and Dynamics",* Pearson Press, 2006.
3. Basudeb Bhattacharyya, "*Engineering Mechanics*", Oxford University Press, 2nd edn., 2016.

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20CS C01

PROGRAMMING FOR PROBLEM SOLVING
(Common to all Programs)

Instruction	3 Periods per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Identification of computer components, Operating environments , IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
4. Develop in tuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and understand the computing environments for scientific and mathematical problems.
2. Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
3. Choose data types and control structures to solve mathematical and scientific problem.
4. Decompose a problem into modules and use functions to implement the modules.
5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high-level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence, and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping, and nested statements.

Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes, Case study using functions and control statements.

UNIT – III

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting (Selection and Bubble) algorithms, 2-D arrays, matrix operations.

Strings: Introduction, strings representation, string operations with examples. Case study using arrays.

UNIT – IV

Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, dynamic memory allocation, advantages, and drawbacks of pointers.

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions, and enumerated data types.

UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.

Preprocessor Directives: Types of preprocessor directives, examples.

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Text Books:

1. M.T. Somashekar "Problem Solving with C", 2nd Edition, Prentice Hall India Learning Private Limited 2018
2. AK Sharma, "Computer Fundamentals and Programming", 2nd Edition, University Press, 2018
3. Pradeep Deyand Manas Ghosh, "Programming in C", Oxford Press, 2^{nd} Edition, 2017

Suggested Reading:

1. Byron Gottfried, Schaum's Outline of Programming with C", Mc Graw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Reema Tharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm.
2. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

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20CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	4 Hours per Week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	2

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theoretical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes

At the end of the course student will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

Chemistry Lab

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2}& Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2}Potentiometrically using $KMnO_4$ solution
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

Text Books:

1. J. Mendham and Thomas , "Vogel's text book of quantitative chemical analysis", Pearson education Pvt. Ltd. New Delhi ,6th ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg & A.Gulati,; R. Chand & Co. : New Delhi (2011).

Suggested Readings:

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S. Chand and Company, 9th revised edition, 2015.

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20CS C02

PROGRAMMING FOR PROBLEM SOLVING LAB
(Common to All Programs)

Instruction	4 Periods per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

Course Objectives: The objectives of this course are

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and setup program development environment.
2. Design and test programs to solve mathematical and scientific problems.
3. Identify and rectify the syntax errors and debug program for semantic errors
4. Implement modular programs using functions.
5. Represent data in arrays, pointers, structures and manipulate them through a program.
6. Create, read, and write to and from simple text files.

Lab experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

Text Books:

1. Pradeep Dey and Manas Ghosh, “Programming in C”, Oxford Press, 2nd Edition, 2017.
2. Reema Tharaja “Introduction to C Programming”, Second Edition, OXFORD Press, 2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

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20ME C02

WORKSHOP / MANUFACTURING PRACTICE

Instruction	5P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive &team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes: At the end of the course, the students are able to

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
3. Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
4. Perform various operations in welding, machining and casting processes.
5. Conceptualize and produce simple device/mechanism of their choice.

List of Exercises

CYCLE 1

Exercises in Carpentry

1. To plane the given wooden piece to required size
2. To make a lap joint on the given wooden piece according to the given dimensions.
3. To make a dove tail-joint on the given wooden piece according to the given dimensions.

Exercises in Tin Smithy

1. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
2. To make a scoop.
3. To make a pamphlet box.

Exercises in Fitting

1. To make a perfect rectangular MS flat and to do parallel cuts using Hacksaw
2. To make male and female fitting using MSflats-Assembly1
3. To make male and female fitting using MSflats-Assembly2

Exercises in House Wiring

1. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch, and wiring of one buzzer controlled by a bellpush
2. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket
3. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- ways witches.

CYCLE 2

Exercises in Casting

1. Study of Sand casting process and its applications.
2. Green sand moulding practice for a single piece pattern
3. Green sand moulding practice for a split pattern with a horizontal core

Exercises in Welding

1. Study of gas welding equipment and process. Identification of flames, making of Butt joint with gas welding.
2. Study of Arc welding process, making Butt joint with DCSP, DCRP
3. Study of Arc welding process, making Lap joint with A.C

Exercises in Machine shop

1. Study of Machine Tools like Lathe, Drilling, Milling and Shaper.
2. Facing, Plain turning and Step turning operations on Lathe machine.
3. Knurling and Taper turning on Lathe machine

Open ended Exercise:

1. Student should produce a component /mechanism by applying the knowledge of any one trade or combination of trades.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I, 2008 and Vol. II, 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata Mc Graw Hill House, 2017.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I", Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

20ME C03

ENGINEERING EXPLORATION
(PRACTICAL)

Instruction	4 Hours per week
Duration of SEE	Nil
SEE	Nil
CIE	50 Marks
Credits	1.5

Prerequisites: Nil

Course Outcomes: At the end of the course, the students are able to

1. Understand the role of an engineer as a problem solver.
2. Identify multi-disciplinary approaches in solving an engineering problem.
3. Build simple systems using engineering design process.
4. Analyze engineering solutions from ethical and sustainability perspectives.
5. Use basics of engineering project management skills in doing projects.

UNIT- I
Role of Engineers: Introduction, science, engineering, technology, engineer, scientist, role of engineer, various disciplines of engineering, misconception of engineering, expectations for the 21st century engineer and NBA graduate attributes.
Engineering problems and Design: Multidisciplinary facet of design, pair wise comparison chart, introduction to econometrics system, generation of multiple solution, Pugh chart, motor and battery sizing concepts, introduction to PCB design.

UNIT- II
Mechanisms: Basic components of a mechanism, degrees of freedom or mobility of a mechanism, 4-bar chain, crank rocker mechanism, slider crank mechanism, simple robotic arm building.
Platform-based development: Introduction to programming platforms (Arduino) and its essentials, sensors, transducers and actuators and their interfacing with Arduino.

UNIT- III
Data Acquisition and Analysis: Types of data, descriptive statistics techniques as applicable to different types of data, types of graphs and their applicability, usage of tools (MS-Office /Open Office/ Libre Office / Scilab) for descriptive statistics, data acquisition (temperature and humidity) using sensors interfaced with Arduino, exporting acquired data to spreadsheets, and analysis using representation.

UNIT- IV
Process Management: Introduction to Agile practice, significance of team work, importance of communication in engineering profession, project management tools, checklist, timeline, Gantt chart, significance of documentation.

UNIT -V
Engineering Ethics & Sustainability in Engineering: Identifying Engineering as a profession, significance of professional ethics, code of conduct for engineers, identifying ethical dimensions in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas.

Sustainability in Engineering: Introduction, sustainability leadership, life cycle assessment, carbon foot print.

Text Books:

1. Clive L. Dym, Patric Little, Elizabeth J Orwin, “Engineering Design: A project-based introduction”, 4th edition, Willey.
2. Matthew Python, “Arduino programming for beginners”, Independently published, 2020.
3. Patrick F. Dunn , “Measurement and data Analysis for engineering and science” , third edition, 2014.
4. Andrew Stellman, Jennifer Greene, “Head First Agile: A brain-friendly guide to Agile principles, ideas, and real-world practices”, Kindle Edition.

Suggested Reading:

1. Charles B. Fleddermann, “Engineering ethics”, fourth edition, Prentice Hall, 2012.
2. Rob Lawlor, “Engineering in society”, second edition, Royal academy of engineering.
3. Richard Dodds, Roger Venables, “Engineering for sustainable development: Guiding principles”, The Royal Academy of engineering, 2005.
4. Richard S. Paul, “Robot Manipulators: Mathematics, Programming, and Control”, MIT Press.

ENGINEERING EXPLORATION ASSESSMENT SCHEME				
S. No	**Name of the module**	**Work Hours**	**Marks**	**Evaluation**
1	Role of Engineers	4	-	Evaluation - I
2	Engineering Design	16	5	
3	Mechanisms	6	3	
4	Engineering Ethics	2	2	
5	Platform-based Development	16	5	Evaluation - II
6	Data Acquisition and Analysis	6	4	Evaluation-III
7	Project Management	4	4	
8	Sustainability in Engineering	6	2	
9	Course Project Reviews	12	20	Final Evaluation
10	Code of conduct	-	5	
	Total	**72**	**50**	

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of II Semester of B.E. – Electrical &Electronics Engineering as per AICTE Model Curriculum 2020-21

B.E. –ELECTRICAL & ELECTRONICS ENGINEERING

SEMESTER -II

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20MT C06	Vector Calculus and Differential Equations	3	1	-	3	40	60	4
2	20EG C01	English	2	-	-	3	40	60	2
3	20PY C06	Electromagnetic Theory and Quantum Mechanics	3	-	-	3	40	60	3
4	20EE C01	Basic Electrical Engineering	3	-	-	3	40	60	3
PRACTICAL									
5	20EG C02	English lab	-	-	2	3	50	50	1
6	20PY C09	Electromagnetic Theory and Quantum Mechanics Lab	-	-	4	3	50	50	2
7	20EE C02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
8	20ME C01	CAD and Drafting	-	1	3	3	50	50	2.5
9	20MB C02	Community Engagement	30 field + 2P/W			-	50	-	1.5
TOTAL			**11**	**2**	**11**	**-**	**410**	**440**	**20**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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20MT C06

VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS
(Common to ECE, EEE, MECH, CHEM, CIVIL)

Instruction	3 L+1T /2P Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives:
1. To explain double and triple integrals of various functions and their significance.
2. To explain Scalar and vector functions with its Physical interpretations.
3. To discuss vector line, surface and volume integrals.
4. To explain relevant methods to solve first order differential equations.
5. To discuss the solution of higher order differential equations.

Course Outcomes:
Upon completing this course, students will be able to:
1. Calculate the areas and volumes.
2. Apply the vector differential operators to Scalars and Vector functions.
3. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
4. Calculate the solutions of first order linear differential equations.
5. Solve higher order linear differential equations.

UNIT-I
Multivariable Calculus (Integration): Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Area enclosed by plane curves, Triple integrals, Volumes of solids.

UNIT-II
Vector Differential Calculus: Scalar and vector point functions, Gradient, Directional derivative, potential function. Divergence, Physical interpretation of Divergence, Curl, Physical interpretation of curl, vector identities.

UNIT-III
Vector Integral Calculus: Line integral, Surface integral and Volume integral, Green's theorem in a plane, Stoke's theorem and Gauss's divergence theorem (without proof).Fluid flow, Physical interpretation of the divergence.

UNIT-IV
First Order Ordinary Differential Equations: Exact differential equations, Equations reducible to exact equations, Linear equations, Bernoulli's equation, Clairaut's equation, Riccati's equation, Orthogonal trajectories, Chemical reactions and solutions, Rate of decay of Radio-active materials.

UNIT-V
Higher Orders Linear Differential Equations: Higher order linear differential equations with constant coefficients, rules for finding Complementary function, Particular Integral and General solution. Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point, regular singular point and Power Series solution. Applications: LR and LCR circuits.

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P.Bali and Dr.Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 9th edition, 2014.
2. R.K.Jain, S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson, Reprint, 2002

20 EG C01

ENGLISH
(Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	2

Course Objectives: This course will introduce the students:
1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

Course Outcomes: After successful completion of the course the students will be able to:
1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques

UNIT-I Understanding Communication in English:
Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.
Vocabulary &Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT-II Developing Writing Skills I:
Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.
Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT-III Developing Writing Skills II:
Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response
Vocabulary and Grammar: Subject-verb agreement.
Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

UNIT-IV Developing Writing Skills III:
Report writing – Importance, structure, elements of style of formal reports ; Writing a formal report.
Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

UNIT-V Developing Reading Skills:
The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar: Words often confused; Use of standard abbreviations.

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Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP. 1995.

Suggested Readings:

1. Wood F.T, Remedial English Grammar, Macmillan, 2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, Communication Skills. Oxford University Press, 2011.

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with effect from the Academic Year 2020-21

20PY C06

ELECTROMAGNETIC THEORY AND QUANTUM MECHANICS
(Common to ECE & EEE)

Instruction	3L / Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

The objectives of the course is to make the student

1. Understand the fundamentals of wave nature of light
2. Familiar with static and dynamic nature of electric and magnetic fields
3. Acquire knowledge of lasers and fiber optics
4. Learn basics of quantum mechanics and properties of solids

Course Outcomes:

At the end of the course, the student will be able to

1. Interpret the wave nature of the light
2. Extend the laws of electric and magnetic fields for wireless communication
3. Explain the principles of lasers and fiber optic communication
4. Find the applications of quantum mechanics
5. Identify semiconductors for engineering applications

UNIT-I

Wave Optics: Huygens' principle – Superposition of waves – Interference of light by wavefront splitting and amplitude splitting –Interference in thin films (reflected light) – Newton's rings – Fraunhofer diffraction from a single slit – Double slit diffraction–Concept of N-slits–Diffraction grating. Polarization: Introduction–Malus's law –Double refraction –Nicol's prism–Quarter-wave plate and half-wave plate– Optical activity– Laurent's half shade polarimeter.

UNIT-II

Electrostatics: Calculation of electric field and electrostatic potential for a charge distribution–Divergence and curl of electrostatic field– Laplace's and Poisson's equations for electrostatic potential–Uniqueness theorem.
Magnetostatics: Bio-Savart law–Divergence and curl of static magnetic field –Equation for magnetic vector potential and its solution for given current densities – Feromagnetic, paramagnetic and diamagnetic materials– B-H curve.
Electromagnetic Theory: Review of steady and varying fields – Conduction current and displacement current–Maxwell's equations in differential and integral forms–Electromagnetic wave propagation in free space, dielectric and conducting media – Poynting theorem – Skindepth.

UNIT-III

Lasers: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion – Ruby laser – He-Ne laser – Semiconductor laser –Applications of lasers in engineering and medicine.
Fiber Optics: Introduction –Construction –Principle –Propagation of light through an optical fiber – Numerical aperture and acceptance angle – Step-index and graded-index fibers –Pulse dispersion –Fiber losses –Fiber optic communication system –Applications.

UNIT-IV

Quantum Mechanics: Introduction –Wave nature of particles – de-Broglie hypothesis –Physical significance of ψ –Time-dependent and time-independent Schrodinger equations – Born interpretation – Probability current –Wave-packets –Uncertainty principle –Particle in infinite square well potential.

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UNIT-V

Physics of Solids and Semiconductors: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level – Bloch's theorem for particles in a periodic potential –Kronig-Penney model – Origin of energy bands –Classification of solids: metals, semiconductors and insulators –Intrinsic and extrinsicsemiconductors–Carriergenerationandrecombination–Carriertransport:diffusionanddrift–P-N junction – Thermistor – Hall effect – LED – Solarcell.

Text Books:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

Suggested Reading:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

20EEC01

BASIC ELECTRICALENGINEERING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To understand the behaviour of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis
2. To understand the basic principle of operation of AC and DC machines
3. To know about different types of electrical wires and cables, domestic and industrial wiring. safety rules and methods of earthing

Course Outcomes: After the completion of this course, the student will be able to

1. Understand the concepts of Kirchhoff's laws and to apply them in superposition, Thevenin's and Norton's theorems to get the solution of simple dc circuits
2. Obtain the steady state response of RLC circuits with AC input and to acquire the basics, relationship between voltage and current in three phase circuits.
3. Understand the principle of operation, the EMF and torque equations and classification of AC and DC machines
4. Explain various tests and speed control methods to determine the characteristic of DC and AC machines.
5. Acquire the knowledge of electrical wiring, types of wires, cables used and Electrical safety precautions to be followed in electrical installations.
6. Recognize importance of earthing, methods of earthing and various low-tension switchgear used in electrical installations

UNIT-I

DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of first-order RL and RC circuits.

UNIT-II

AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III

Transformers: Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation

UNIT-IV

DC and AC Machines: DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators.
DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors.
Three - Phase Induction Motors: Principle of operation, Applications,

UNIT-V

Electrical Installations: Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules.
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Earthing (Elementary Treatment only), Elementary calculations for energy consumption

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Text Books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989
3. D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009
4. P.V. Prasad, S. Sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013

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20EG C02

ENGLISH LAB

(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives: This course will introduce the students:

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behavior while developing their ability to discuss in groups and making oral presentations.

Course Outcomes: After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams, and discuss and participate in Group discussions.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm & Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material
6. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary –** weaving an imaginative story around a given picture.
9. **Information Gap Activity –** Writing a brief report on a newspaper headline by building on the hints given
10. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd., 2011
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016

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20PY C09

ELECTROMAGNETIC THEORY AND QUANTUM MECHANICS LAB
(Common to ECE & EEE)

Instruction	4 Periods / Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

Course Objectives:

The objectives of the course is to make the student

1. Apply the concepts of physics while doing experiments
2. Understand the nature of the light experimentally
3. Analyze the behaviour of semiconductor materials and optoelectronic devices

Course Outcomes:

At the end of the course, the student will be able to

1. Experiment with the concept of errors and find the ways to minimize the errors
2. Demonstrate properties of light experimentally
3. Find the applications of lasers and optical fibers in engineering applications
4. Make use of semiconductor devices for practical applications
5. Illustrate the working of optoelectronic devices

Experiments

1.	Error Analysis	:	Estimation of errors in the determination of time period of a torsional pendulum
2.	Newton's Rings	:	Determination of wavelength of given monochromatic source
3.	Single Slit Diffraction	:	Determination of wavelength of given monochromatic source
4.	Diffraction Grating	:	Determination of wavelengths of two yellow lines of light of mercury lamp
5.	Malus's Law	:	Verification of Malus's law
6.	Double Refraction	:	Determination of refractive indices of O-ray and E-ray of given calcite crystal
7.	Polarimeter	:	Determination of specific rotation of glucose
8.	Laser	:	Determination of wavelength of given semiconductor laser
9.	Optical Fiber	:	Determination of numerical aperture and power losses of given optical fiber
10.	Energy Gap	:	Determination of energy gap of given semiconductor
11.	P-N Junction Diode	:	Study of V-I characteristics and calculation of resistance of given diode in forward bias and reverse bias
12.	Thermistor	:	Determination of temperature coefficient of resistance of given thermistor
13.	Hall Effect	:	Determination of Hall coefficient, carrier concentration and mobility of charge carriers of given semiconductor specimen
14.	LED	:	Study of I-V characteristics of given LED
15.	Solar Cell	:	Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance

NOTE: A minimum of TWELVE experiments should be conducted.

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20EEC02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements and to verify the basic electrical circuit laws and theorems.
2. To determine the parameters and power factor of a coil, calculate the time and frequency responses of RLC circuits and to familiarize with measurement of electric power & energy.
3. To determine the characteristics of Transformers, dc, ac machines and switch gear components

Course Outcomes: At the end of the course, the students are expected to

1. Get an exposure to common electrical components, their ratings and basic electrical measuring equipment.
2. Make electrical connections by wires of appropriate ratings and able to measure electric power and energy.
3. Comprehend the circuit analysis techniques using various circuital laws and theorems.
4. Determine the parameters of the given coil and calculate the time response of RL & RC series circuits.
5. Recognize the basic characteristics of transformer and components of switch gear.
6. Understand the basic characteristics of dc and ac machine by conducting different types of tests on them.

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components.
2. Verification of KCL and KVL.
3. Time response of RL and RC series circuits.
4. Determination of parameters of a choke or coil by Wattmeter Method
5. Verification of Thevenin's and Norton's theorems
6. Turns ratio /voltage ratio verification of single phase Transformers
7. Open Circuit and Short Circuit tests on a given single phase Transformer
8. Observation of Excitation Phenomenon in Transformer
9. Measurement of three phase power in a balanced system using two Wattmeter method.
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle)
11. Load test on DC Shunt motor
12. Speed control of DC Shunt motor
13. Demonstration of Low Tension Switchgear Equipment/Components
14. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: TEN experiments to be conducted from the above list.

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20ME C01

CAD AND DRAFTING

Instruction	1 T + 3 D Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives:

1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

Outcomes: At the end of the course, the Students are able to

1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

List of Exercises:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice versa.

Text Books:

1. N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishers, 2012.
2. K.Venugopal, “Engineering Drawing and Graphics + AutoCAD”, New Age International Pvt. Ltd, 2011.
3. Basanth Agrawal and C M Agrawal, “Engineering Drawing”, 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., “Engineering Drawing”, 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011.

20MBC02

COMMUNITY ENGAGEMENT

Instruction	3 Hours per week (30 hours field work & 2 hours per week)
SEE	Nil
CIE	50 Marks
Credits	1.5 Credits

Course Objectives: The main Objectives of this Course are to:

1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

Course Outcomes: After the completion of this Course, Student will be able to:

2. Gain an understanding of Rural life, Culture and Social realities.
3. Develop a sense of empathy and bonds of mutuality with Local Communities.
4. Appreciate significant contributions of Local communities to Indian Society and Economy.
5. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
6. Utilise the opportunities provided by Rural Development Programmes.

Module I Appreciation of Rural Society
Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

Module II Understanding Rural Economy and Livelihood
Agriculture, Farming, Landownership, Water management, Animal Husbandry, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III Rural Institutions
Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees, Local Civil Society, Local Administration.

Module IV Rural Development Programmes
History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

Text Books:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

Journals:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).

Scheme of Instruction and Syllabi

of

BE / B.TECH B.E. (EEE) III to IV SEMESTERS

of

FOUR YEAR DEGREE COURSE

IN

B.E. (EEE)

under AICTE Model Curriculum

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTION AND EXAMINATION
B.E/B.Tech under AICTE Model Curriculum
B.E. (EEE)

SEMESTER-III

Sl. No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L	T	P	Scheme of Examination: Duration in Hours	Maximum Marks CIE	SEE	Credits
1.	18MT C07	Applied mathematics	3	1	-	3	30	70	4
2.	18EE C03	Analog Electronic Circuits	3	1	-	3	30	70	4
3.	18EE C04	Electrical Measurements and Instrumentation	3	-	-	3	30	70	3
4.	18EE C05	Electromagnetic Fields	3	1	-	3	30	70	4
5.	18EE C06	Electrical Circuit Analysis	3	1	-	3	30	70	4
6.	18EG M 01	Indian constitution	2	-	-	2	-	50	-
7.	18EE M01	Indian Traditional Knowledge	2	-	-	2	-	50	-
		PRACTICALS							
8.	18EE C07	Analog Electronic Circuits Lab	-	-	2	2	15	35	1
9.	18EE C08	Electrical Measurements and Instrumentation Lab	-	-	2	2	15	35	1
		Total	19	4	4	-	180	520	21

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Core Courses offered to other Departments:

SEMESTER-III

Sl. No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L	T	P	Scheme of Examination: Duration in Hours	Maximum Marks CIE	SEE	Credits
1	18EE C01	Basic Electrical and Electronics Engineering	3	1	-	3	30	70	4
		PRACTICALS							
2	18EE C02	Basic Electrical and Electronics Engineering Lab	-	-	2	2	15	35	1

18MT C07

APPLIED MATHEMATICS
(For ECE/EEE)

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:
1. To form PDE and solve Linear and Non-Linear equations.
2. To learn the Laplace, Inverse Laplace Transform and Z-Transforms.
3. To find roots of equations, interpolation and Numerical differentiation.
4. To learn Numerical solution of ODE and Engineering problems.
5. To learn fitting of distribution and predicting the future values.

Course outcomes: After completion of this course, students will be able to:
1. Understand the methods to find solution of linear and non-linear PDE and solution of wave equation.
2. Find Laplace, Inverse Laplace and Z-Transforms and solution of engineering problems.
3. Solve Non-Linear algebraic and transcendental equations to find interpolations when tabular values are given.
4. Find solution of initial value problems of ODE.
5. Understand the Methods for analysing the random fluctuations using probability distribution and also identify the importance of principle of Least squares approximations for predictions.

UNIT-I
Partial Differential Equations: Formation of Partial Differential Equations, Solution of Linear (Lagrange's) and Non-linear PDE of First order standard forms and Charpit's Method, Solutions of PDE by method of separation of variables, solution of one dimensional wave equation and its applications.

UNIT-II
Transform Theory: Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by partial fractions and residue method, solving ODEs by Laplace Transform method.Z-transforms and its basic properties, inverse Z-transform and solutions of difference equation by Z-transform.

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UNIT-III

Numerical Analysis: Solution of Algebraic and transcendental equations by Bisection method, Newton-Raphson method and Regula-Falsi method. Interpolation, Newton's forward and backward difference formulae.Newton's divided difference and Lagrange'sformulae.Numerical Differentiation.

UNIT-IV

Numerical Solutions of ODE: Solutions of First Order Ordinary differential equations, Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator corrector methods.

UNIT-V

Basic Statistics: Measures of Central tendency for continuous random variable, Moments, skewness and Kurtosis, Probability distributions: Normal (Gaussian),Rayleigh, Exponential and uniform distributions Correlation and regression. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas.

Text Books:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, "Numerical Methods", S. Chand & Company, 2nd Edition, Reprint 2012.
2. S.S. Sastry, "Introductory methods of numerical analysis", PHI, 4th Edition, 2005.
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 35th Edition, 2010.
4. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

Suggested Reading:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2008.
3. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

> ***Education*** *is the process of imparting knowledge, values, skills and attitudes, which can be beneficial to an individual. On the contrary,* ***Learning*** *is the process of adopting knowledge, values and skills.*
>
> Concept-Based Curriculum and Instruction

18EE C03

ANALOG ELECTRONIC CIRCUITS

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the characteristics of diodes, BJTs, MOSFETS and the biasing techniques of transistors.
   2. To understand the functioning, DC characteristics of operational amplifiers and also different linear applications of operational amplifiers
3. Study the different non-linear applications of operational amplifiers

Course Outcomes: After completion of this course, students will be able to:

1. Analyze the characteristics of Diodes ,transistors and MOFETS.
2. Understand biasing techniques of transistor and its application as differential and multi stage amplifier
3. Understand the basic characteristics of op-amps and their significance.
4. Analyze different linear application circuits of operational amplifiers
5. Analyze different non-linear application circuits of operational amplifiers

UNIT-I

Diode circuits and BJT Circuits: P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes.
Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits.

UNIT-II

MOSFET Circuits: MOSFET structure and I-V characteristics, MOSFET as a switch, MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers, small signal equivalent circuits, gain, input and output impedances, trans-conductance.

UNIT-III

Differential, multi-stage and operational amplifiers: Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational

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amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

UNIT-IV

Linear applications of op-amp: Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers, Series voltage regulator , oscillators (Wein bridge and phase shift).

UNIT-V

Nonlinear applications of op-amp: Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot. clamping and clipping circuits

Text Books:

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. Analog Electronics, A.K. Maini, Khanna Publishing House

Suggested Readings:

1. Millman and Halkias, " Electronic Devices and Circuits" 2nd Edition, McGraw Hill Publication 2007.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009
3. D.Roy Choudhury, Linear Integrated Circuits, Shail B.Jain, , New Age Intern.(P) Ltd., 3rd Edition 2007.
4. Gayakwad R.A. Op-Amps and Linear Integrated Circuits, PHI, 4th Edition, 2002.
5. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press 2008.

18EE C04

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the principle behind various instruments.
2. To know the various bridges for measurement of R, L and C.
3. To measure various magnetic and electric parameters.

Course Outcomes: After completion this course, students will be able to:

1. Identify a suitable instrument to measure a given parameter.
2. Analyze the need of CT/PT for a given system.
3. Illustrate the concept of the instrument with relevant examples and proper justification.
4. Distinguish between electrical and magnetic measurements and their instruments.
5. Specify the right transducer for a given requirement.

UNIT-I

Introduction to Measurements: Objectives of measurement, static and dynamic characteristics, errors and their classification.

Introduction to Instruments-1: Types of instruments, classification of instruments based on type of measurement and principle of working (PMMC, MI, Dynamometer, Induction and Electrostatic), types of torques (torque equations for MC, MI and dynamometer type instruments).

UNIT-II

Introduction to Instruments-2: Single phase Induction type energy meter, concept of driving torque & braking torque equations, (no derivation) ; Errors and their Compensation, Single phase Dynamometer type Power factor meter, Weston type frequency meter. Construction & theory of Instrument Transformers, Equations for ratio and phase angle error of C.T & P.T (Elementary treatment only).

UNIT-III

Resistance, Inductance and Capacitance parameters: Classification of resistance measuring methods Kelvin's double bridge, Wheatstone bridge and meggar.

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Measurement of inductance using Maxwell's inductance bridge, Anderson's bridge. Measurement of capacitance using De-Sauty's bridge and Schering bridge., merits and demerits, applications and related numerical problems.

UNIT-IV

Measurements of Magnetic and Electric Parameters: Ballistic galvanometer-Principle of operation, construction and applications of Ballistic galvanometer, flux meter its construction and principle of operation. Epstein square bridge for measuring Iron losses. Potentiometers,-Principle - Classification – Salient features related to Practical applicability.

UNIT-V

Introduction to Digital Instruments (DVM and Transducers): Introduction to digital Instruments, Digital Voltmeters (DVM), Speed reading, Range selection, Over ranging, Common mode rejection, Digital Multi meters.

Transducers: Introduction, Role of Transducers in measurement system, Strain Gauge, Linear variable Differential transformer (LVDT), Temperature transducers, bimetallic strip, Thermocouples, Resistance Temperature Detectors (RTD), Thermostats, Radiation pyrometers.

Text Books:

1. F.W.Golding and Widdis, Electrical Measurements and measuring Instruments, A.H.Wheeler & Co., 5th Edition, 2007.
2. A.K.Sawhney, A Course in Electrical and Electronics Measurements and Instrumentation, Dhanapat Rai & Sons, NewDelhi, 19th Edition, 2011.
3. CT. Baldwin, Fundamentals of Electrical measurements, Kalyani publications, 2001.

Suggested Readings:

1. Helfrick, Albert D., Cooper, William D., Modern Electronic Instrumentation and Measurement Techniques, PHI Publications, 1990.
2. Stanley Wold, Richard F.M.Smith, Student reference manual for Electronic Instrumentation Laboratories, 2nd Edition, PHI.
3. Alan. S. Morris, Essence of Measurement, PHI, 1996.

Teaching with dialogue education involves listening to learners at every level, respecting them as subjects or decision makers of their own learning and evoking their innate power.

Concept-Based Curriculum and Instruction

18EE C05

ELECTROMAGNETIC FIELDS

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand coordinate systems, vector calculus and their applications to electrostatic and magnetic fields.
2. To figure out Maxwell's equations, uniform plane wave and its propagation through different media.
3. To know the sources, effects & control techniques of EMI & EMC.

Course Outcomes: After completion of this course, students will be able to

1. Recognize the importance of different coordinate systems and vector calculus in EM theory.
2. Analyze electric and magnetic field intensity, flux density and potential due to various charge configurations.
3. Differentiate between conduction & convection currents through various materials.
4. Illustrate the Maxwell's equations and EM wave equations in different media.
5. Identify EMI & EMC, the causes and effects, various control methods of EMI.

UNIT-I

Orthogonal Coordinate Systems: Review of Vector Calculus, Rectangular, Cylindrical, Spherical coordinate systems; Line, Surface and Volume integrals; Operator Del, Gradient, Divergence, Curl & Laplacian of a field; Divergence and Stoke theorems.

Electrostatic fields: Various charge configurations, Coulomb's law, Electric field intensity and flux density of different charge distributions, Gauss law, Integral and Point form of Maxwell's Electrostatic Equation.

UNIT-II

Electrostatic Field in Materials: Electrical Potential, Capacitance of Parallel plate capacitor, Equi-potential lines, Properties of materials, convection and conduction currents, conductors, dielectric constant, continuity equation and relaxation

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time, boundary conditions, Poisson's and Laplace's equations, Uniqueness theorem.

UNIT-III

Magneto Static Fields: Biot-Savart's law, Ampere's law, Displacement current, Magnetic scalar and Vector Potentials, boundary conditions, Forces in Magnetic fields, Lorentz force equation, Force between parallel conductors, Inductance Calculations (Solenoid, Toroid), Mutual Inductance.

UNIT-IV

Time Varying Electromagnetic Fields: Faraday's laws of electromagnetic induction, Final forms of Maxwell's Equations, Power and Poynting theorem, Time-Harmonic Electromagnetic fields, Wave equations (One dimension), Plane Wave, Propagation in perfect and lossy-dielectrics.

UNIT-V

Electromagnetic Interference and Compatibility (Theoretical Aspects only): Introduction to Electromagnetic Interference and Electromagnetic Compatibility (EMI & EMC)- Sources and Characteristics of EMI, Control Techniques of EMI, Grounding, Shielding, Filtering. Introduction to numerical electromagnetic.

Text Books:

1. Hayt, W.H and J.A Buck, Engineering Electromagnetics, Tata McGraw Hill, 8th Edition, 2014.
2. Sadiku, M.N.O,S.V. Kulkarni, Principles of Electromagnetics, Oxford University press, 6th Edition, 2015.

Suggested Readings:

1. S. P. Seth, Elements of Electromagnetic Fields, Danpat Rai& Co, 2011.
2. David K. Cheng, Field and Wave Electromagnetics, Pearson Education. 2nd Edition 2014.
3. Ashutosh Pramanik, Electromagnetism Theory and Applications, PHI Pvt. Ltd., 3rd Edition, 2014.

18EE C06

ELECTRICAL CIRCUIT ANALYSIS

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the nature of different circuit elements, laws and network theorems.
2. To study transient response of circuits with initial conditions & forcing functions and also basics of network topology.
3. To understand the Laplace transforms and two-port networks.

Course Outcomes: After completion of this course, students will be able to:

1. Apply network theorems for the analysis of electrical circuits.
2. Understand the circuit analysis using graph theory &Coupled circuits.
3. Obtain the transient and steady-state response of electrical circuits.
4. Analyze circuits using Laplace transformations.
5. Analyze behavior of two port networks.

UNITI

Sinusoidal steady state analysis: Review of AC fundamentals, effective or RMS values, Steady state response of RLC networks with sinusoidal excitations, average power and complex power, series and parallel resonance, Three phase circuits with balanced & unbalanced loads, Displacement neutral, Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

UNITII

Network Theorems: Node and Mesh Analysis, Analysis with dependent current and voltage sources, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation and Milliman's theorems.

UNITIII

Graph Theory: Formation of Incident, fundamental Tie-set and Cut-set matrices, Concept of duality and dual networks.

Solution of First and Second order networks: Review of solution of first and second order differential equations for Series and parallel RL, RC, RLC circuits,

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initial and final conditions in network elements, forced and force-free responses, time constant, steady state and transient state responses.

UNITIV

Electrical Circuit Analysis Using Laplace Transforms: Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots),

UNITV

Two Port Networks: Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Text Books:

1. M. E. Van Valkenburg, "Network Analysis", 3rd Edition, Prentice Hall, 2015.

2. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits",6th Edition, McGraw Hill Education, 2019.

3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education2013.

Suggested Reading:

1. D. Roy Choudhury, "Networks and Systems", 2nd Edition, New Age International, 2010.
2. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 2002.

18EG M 01

INDIAN CONSTITUTION

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks

Course Objectives:The course will introduce the students to :

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes :After successful completion of the course the students will be able to :

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right To Liberty.

Unit-I

Constitution of India - Introduction and salient features . Constitutional history. Directive Principles of State Policy - Its importance and implementation.

Unit II

Union Government and its Administration - Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States.

Parliamentary form of government in India. President: role, power and position.

Unit III

Emergency Provisions in India - National emergency, President rule, Financial emergency

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Unit IV

Local Self Government - District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

Unit V

Scheme Of The Fundamental Rights & Duties: Fundamental Duties - the legal status.

Scheme Of The Fundamental Rights - To Equality, to certain Freedom Under Article 19, to Life And Personal Liberty Under Article 21.

Suggested Reading:

1. **The Constitution of India**, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, **Framing of Indian Constitution**, 1st Edition, 2015.
3. M. P. Jain, **Indian Constitution Law**, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu**, Introduction to the Constitution of India**, Lexis Nexis, 2015

Online Resources:

http://www.nptel.ac.in/courses/103107084/Script.pdf

18EE M01

INDIAN TRADITIONAL KNOWELDGE

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Credits	0

Course Objectives:

1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Course Outcomes: After completion of this course, students will be able to:

1. Understand philosophy of Indian culture
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras.

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II

Indian Languages, Culture and Literature:

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV

Fine arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science

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and Technology in India, development of science in ancient, medieval and modern India

UNIT-V

Education system in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. Kapil Kapoor, Text and Interpretation: The India Tradition,ISBN: 81246033375, 2005
2. Science in Samskrit, Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. S. Narain, Examinations in ancient India, Arya Book Depot, 1993
4. Satya Prakash, Founders of Sciences in Ancient India, Vijay Kumar Publisher, 1989
5. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Reading:

1. Kapil Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
2. Karan Singh, A Treasury of Indian Wisdom: An Anthology of Spiritual Learn, ISBN: 978-0143426158, 2016.

18EE C07

ANALOG ELECTRONICS CIRCUTS LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course objectives:

1. The V-I Characteristics of diode, Transistor and MOSFET.
2. The frequency response of BJT and FET amplifiers and the performance analysis of multistage amplifiers.
3. To analyze and design various applications of Op-Amp.

Course Outcomes: After completion of this course, students will be able to:

1. Verify the working of PN junction diodes, transistors and their characteristic behavior.
2. Design various rectifiers with different filter combinations.
3. Set up bias point in a transistor.
4. Build a multi stage amplifier and find the frequency response of amplifier.
5. Design and analyze circuits for inverting and non-inverting amplifiers, and linear and non linear applications of Op-Amp

LIST OF EXPERIMENTS

Part A

1. V-I characteristics of (Silicon and Germanium) diodes and measurement of static and dynamic resistance.
2. Zener diode characteristics and its application as an voltage regulator.
3. (a) Design, realization and performance evaluation of rectifier circuits with and without filters (C & ð section) Half wave rectifier.
   (b) Design, realization and performance evaluation of rectifier circuits with and without filters (C & ð section) Full wave rectifier.
4. Plotting the characteristics of BJT and MOSFET.
5. Design of Biasing circuits for BJT
6. Design and Frequency response of Common Emitter BJT amplifier and measurement of Gain, Bandwidth, Input and Output impedances.
7. Design and Frequency response of Single stage and Multi stage RC coupled amplifier using BJT.

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Part B

1. Measurements of Op Amp parameters:
2. Inverting and Non Inverting Amplifiers
3. Design of integrator and differentiator using Op-Amp.
4. Generation of triangular, sine and square wave using IC's.
5. Peak Clamper using Op-Amps.
6. Clippers using Op-Amps..
7. Schmitt Trigger,

Note: At least **FIVE** experiments from **Part-A** and **FIVE** from **Part-B** should be conducted in the semester.

18EE C08

ELECTRICAL MEASUREMENTS AND INSTRUMENTATIONLAB

Instruction	2 Hours per week
Duration of Semester End Exam	2 Hours
Semester End Exam	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To understand the various Electrical Measuring instruments for measuring various
electrical quantities.
2. To measure the unknown values of different electrical elements.
3. To become familiar with digital instruments.

Course Outcomes: After completion of this course, students will be able to:

1. Design and validate DC and AC bridges.
2. Learn about various measurements devices, their characteristics and limitations.
3. Understand the operation of DSO and analyse various signals.
4. Demonstrate the principles of magnetic measurements.
5. Select the right instrument for the given circuit.

LISTOF EXPERIMENTS

1. Calibration of single-phase energy meter with Phantom Loading.
2. Measurement of high resistance and insulation resistance using Megger.
3. Measurement of iron losses using Epstein's square bridge.
4. Measurement of unknown frequency using Lissajous Patterns.
5. Study of Digital Instruments
6. Measurement of bandwidth and sampling rate of a signal using DSO.
7. Usage of DSO to capture transients in RLC circuits.
8. Measurement of unknown resistance using Kelvin's double bridge.
9. Measurement of unknown Inductance using Maxwell's bridge and validating with LCR meter.
10. Measurement of unknown inductance using Anderson's bridge and validating with LCR meter.
11. Measurement of unknown capacitance using Schering bridge and validating with LCR meter.

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12. Measurement of strain using strain gauge.
13. Measurement of Displacement using LVDT.
14. Measurement of unknown voltage using D.C Crompton's potentiometer.
15. Study of current transformer and potential transformer.

Note: At least **TEN** experiments should be conducted in the semester.

18EE C01

BASICELECTRICALENGINEERING

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.,
3. To understand the basic principle of operation of Transformer and DC machines
4. To understand the basic principle of operation of DC machines and AC machines
5. To know about different types of electrical wires and cables, domestic and industrial wiring.
6. To understand safety rules and methods of earthing

Course Outcomes: At the end of the course, the student will be able to

1. Acquire the concepts of Kirchhoff's laws and network theorems and able to get the solution of simple dc circuits
2. Obtain the steady state response of RLC circuits and also determine the different powers in AC circuits
3. Acquire the concepts of principle of operation of Transformers and DC machines
4. Acquire the concepts of principle of operation of DC machines and AC machines
5. Acquire the knowledge of electrical wiring and cables and electrical safety precautions
6. Recognize importance of earthing and methods of earthing and electrical installations

UNIT-I:

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation,

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Superposition, Thevenin and Norton Theorems, Time-domain analysis of first-order RL and RC circuits.

UNIT-II:

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III:

Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation, Auto transformer.

UNIT-IV:

DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators.

DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors.

Three - Phase Induction Motors: Construction, Principle of operation, Torque equation, torque-slip characteristics, Power stages, speed control of induction motors.

UNIT-V:

Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules.

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Earthing, Elementary calculations for energy consumption.

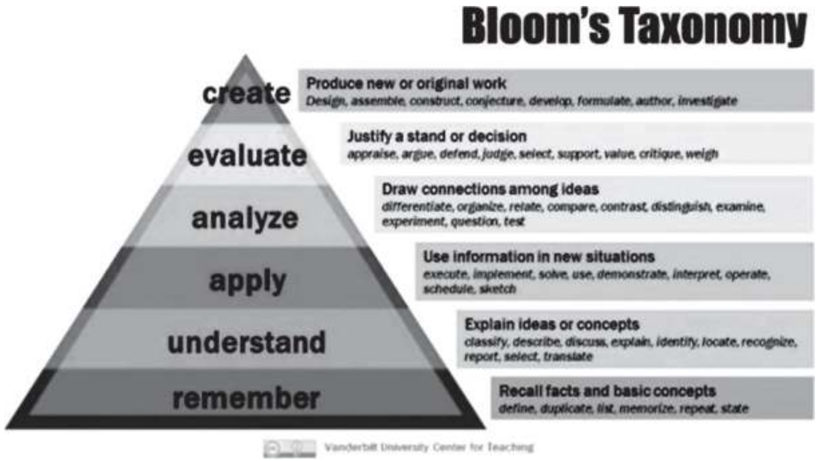
Text books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989
3. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill,2009
4. P.V.Prasad, S.sivanagaraju, R.Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013.



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18EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements.
2. To verify the basic electrical circuit laws and theorems.
3. To determine the parameters and power factor of a coil.
4. To calculate the time and frequency responses of RLC circuits
5. To determine the characteristics of Transformers
6. To determine the characteristics of dc and ac machines

Course Outcomes: At the end of the course, the students are expected to

1. Get an exposure to common electrical components and their ratings
2. Make electrical connections by wires of appropriate ratings
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer
6. Understand the basic characteristics of dc and ac machines

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components
2. Verification of KCL and KVL
3. Time response of RL and RC circuits
4. Calculation of permittivity of a choke or coil by Wattmeter Method
5. Verification of Thevenin's and Norton's theorems
6. Turns ratio /voltage ratio verification of 1-Ph Transformers
7. OC and SC tests on a given 1-Ph Transformer
8. Observation of Excitation Phenomenon in Transformer
9. Measurement of 3-Ph power in a balanced system (By 2- Wattmeter method)
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle)
11. Load test of DC Shunt motor
12. Speed control of DC Shunt motor

13. Load test of 3-Ph Induction motor
14. Demonstration of LT Switchgear Equipment/Components
15. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: at least **TEN** experiments should be conducted in the semester

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTION AND EXAMINATION
B.E/B.Tech under AICTE Model Curriculum
B.E. (EEE)

SEMESTER-IV

Sl. No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L	T	P	Scheme of Examination: Duration In Hours	Maximum Marks CIE	SEE	Credits
1.	18CS C05	Basics of Data Structures	2	-	-	3	30	70	2
2.	18EE C09	Digital Electronics	3	-	-	3	30	70	3
3.	18EE C10	Electrical Machines-1	3	1	-	3	30	70	4
4.	18EE C11	Power Systems-I	3	-	-	3	30	70	3
5.	18ME C09	Principles of Management	3	-	-	3	30	70	3
6.	18CE M01	Environmental Science	2	-	-	2	-	50	-
PRACTICALS									
7.	18CS C06	Basics of Data Structures lab	-	-	2	2	15	35	1
8.	18EE C12	Digital Electronics Lab	-	-	2	2	15	35	1
9.	18EE C13	Electrical Machines-1 Lab	-	-	2	2	15	35	1
10.	18EG C03	Soft Skills Lab	-	-	2	2	15	35	1
		Total	**16**	**1**	**8**		**210**	**540**	**19**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

18CS C05

BASICS OF DATA STRUCTURES
(Common for other Programmes)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	2

Pre-requisites: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives:
1. To basic linear and non-linear data structures.
2. To analyzing the performance of operations on data structures.
3. To different sorting and searching techniques and their complexities.

Course Outcomes: After completion of this course, students will be able to:
1. Understand the basic concepts of data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Choose and apply an appropriate data structure for a specified application.
4. Understand the concepts of recursion and its applications in problem solving.
5. Demonstrate a thorough understanding of searching and sorting algorithms.

UNIT - I
Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff.
Recursion: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT - II
Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

UNIT-III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications.

UNIT-IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT-V

Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.

Searching and Sorting: Linear searching, binary Searching, sorting algorithms- bubble sort, selection sort, quick sort, heap sort.

Text Books:

1. Narasimhaarumanchi, Data Structures and Algorithms Made Easy, CareerMonk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, Fundamentals of Data structures in C,E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, Data Structures using C, Oxford University Press.

Suggested Reading:

1. D.S.Kushwaha and A.K.Misra, Data structures A Programming Approach with C, PHI.
2. Seymour Lipschutz, Data Structures with C, Schaums Outlines, Kindle Edition

18EE C09

DIGITAL ELECTRONICS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the working of logic families and logic gates
2. To know the design and implementation of combinational and sequential logic circuits.
3. To Understand the process of A/D and D/A conversions and PLD's in implementing the given logical problems.

Course Outcomes: After completion of this course, students will be able to:

1. Understand working of logic families and logic gates.
2. Design and implement combinational digital circuits.
3. Design and implement Sequential logic circuits
4. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
5. Be able to use PLD's to implement the given logical problems.

UNIT–I

Fundamentals of Digital Systems and Logic families: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri – state logic.

UNIT–II

Combinational Digital Circuits: Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, digital comparator, parity checker/generator, code converters, priority encoders, decoders/Seven segment display device, Q-M method of function realization.

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UNIT–III

Sequential circuits and systems: A 1-bit memory, the circuit properties of bi-stable latch, the clocked SR flip flop, J- K-T and D-types flip-flops, applications of flip-flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, applications of counters.

UNIT–IV

A/D and D/A Converters: Digital to analog converters: weighted resistor/ converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage of frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

UNIT–V

Semiconductor memories and Programmable logic devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic.

Text Books:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

Suggested Readings:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. S. Salivahanan " Digital circuits and design", 4th edition, Vikas Publishing house, 2010.

18EE C10

ELECTRICAL MACHINES-I

Instruction	3L + 1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To Inculcate the principles of Electromechanical Energy Conversions.
2. To analyze the performance aspects of DC Machines.
3. To Impart knowledge of poly phase transformer.

Course Outcomes: After completion of this course, students will able to:-

1. To understand the concepts of electromechanical energy conversion.
2. Acquire the knowledge of Construction, operation characteristics of DC generators.
3. Evaluate performance characteristics, testing and applications of DC Motors.
4. Describe operation, regulation and efficiency of single phase transformer.
5. Analyze the three phase transformer connections and cooling methods.

UNIT-I

Electromechanical energy conversion: Forces and torques in magnetic field system, energy balance, singly excited and multiple excited magnetic systems, co energy. MMF, flux, reluctance, series and parallel magnetic circuits, B-H curve of magnetic materials.

UNIT-II

DC Generators: Constructional features of a DC machine, Principle of operation, armature windings diagram (Lap and Wave winding), EMF equation of a DC generator, Armature reaction and its effects, process of commutation, methods of improving commutation, methods of excitation and classification of DC generators, voltage build-up in a shunt generator, critical field resistance and critical speed, generator characteristics, losses and efficiency, parallel operation and applications of DC generators.

UNIT-III

DC Motors: Principle of operation, back EMF and significance of back EMF, electromagnetic torque, types of DC motors, characteristics, speed control of DC motors, necessity of starter, three point starter and four point starter, losses and efficiency, applications of DC motors.

Testing of DC machines: Swinburne's test, brake test, Hopkinson's test, fields test, retardation test and separation of losses.

UNIT-IV

Single Phase Transformer : Constructional features, principle of operation, EMF equation, ideal transformer, transformer on NO load and ON load and its phasor diagrams, equivalent circuit, losses in transformer, voltage regulation and efficiency, All day efficiency, parallel operation of transformer.

Testing of transformer: Polarity test, Open circuit and short circuit test, Sumpner's test, separation of losses.

Auto transformer: - Construction, principle, applications and comparison with two winding transformer

UNIT-V

Three Phase Transformers: Construction, types of connection and their comparative features, Scott connection. Tap-changing transformers: No-load and on-load tap-changing of transformers, Three- winding transformers, Cooling of transformers.

Text Books:

1. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
3. H.Cotton, Advanced Electrical Technology, Wheeler & Co, CBS publishers, 7th Edition, 2005.
4. J.B Gupta, Theory and performance of electrical machines, S.K. Kataria & Sons, 14th Edition, 2014.

Suggested Readings:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. Ashfaq Hussain "Electrical Machines" Danapatrai and sons, 3rd Edition 2012.

18EE C11

POWER SYSTEMS - I

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce Generation of energy through conventional sources such as: Thermal, Hydro and Nuclear and renewable energy sources
2. To familiarize mechanical design of transmission lines and cables.
3. To familiarize present practices in tariff calculations and understand the classification and connection schemes of distribution systems

Course Outcomes: After completion of this course, students will be able to:

1. Gain knowledge of construction and operation of conventional and non-conventional sources of energy along with financial management
2. Know the effects sag on transmission lines.
3. Acquire the concepts to study the performance of insulators and cables
4. Understand the concept of Overhead Transmission Lines and Cable
5. Understand the concept of Economics of Power Generation and the concept of AC and DC distribution.

UNIT-I

Basic Concepts : Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids.

Generation: Thermal- Hydro -Power Plants: Principles, Choice of site, layout and various parts of generating stations, Brief description of Hydro Power Plant Dam, Spillways, Head works, Surge tank, Penstocks, Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses, Brief description of TPS components: Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and Cooling towers.

Nuclear Station: Schematic Arrangement of Nuclear Power Station, Advantages and disadvantages, Types of Nuclear reactors

UNIT-II

Solar and Wind Sources: Solar cell fundamentals, Solar Cell characteristics, solar cell classification, solar cell, Module, Panel and Array Construction,

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Maximizing the solar PV output and load matching, Solar PV Systems
Basic Principles of Wind Energy Conversion, The Nature of the Wind, The Power in the Wind, Forces on the Blades, Wind Energy Conversion, Wind Data and Energy Estimation, Site Selection Considerations.

UNIT-III

Line Parameter Calculations: Inductance & Capacitance calculations of Transmission Line, single-phase and three-phase symmetrical composite conductors, GMD, GMR, Transposition of conductors, Bundled conductors, effect of earth capacitance.

UNIT-IV

Overhead Transmission Lines and Cables: Overhead line materials, supports, types, Ground wires, Sag /Tension calculations, Equal / Unequal supports, Effects of wind, ice / Erection Conditions Stringing charts. Insulators, Types, Material for construction, potential distribution over string of insulators, equalizing of potential, Methods.
Underground Cables: Construction of Cables, Insulating Materials for Cables, Classification of Cables, Insulation Resistance of a Single-Core Cable, Capacitance of a Single-Core Cable, Dielectric Stress in a Single-Core Cable, Most Economical Conductor Size in a Cable, Grading of Cables,Capacitance Grading, Inters heath Grading, Capacitance of 3-Core Cables, Measurements of Ce and Cc.

UNIT-V

Economics of Power Generation: Load curve, Load demand and diversified factors, Base load operation, Types of costs and depreciation calculations; Tariffs, different types of tariffs; Methods of power factor improvement.
General Aspects of AC and DC Distribution Systems-Types of D.C. & A.C Distributors, Calculations for Distributor fed at one end, distributor fed at both ends.

Text Books:

1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.
2. C.L.Wadhwa, "Electric Power Systems Theory", New Academic science Limited, 2012.
3. B.H. Khan, "Non Conventional Energy Resources" Mc Graw Hill Education, 2015.

Suggested Reading:

1. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
2. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill, 2003.
3. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.

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18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To make the students to

1. To Understand basic fundamentals and insights of management
2. To Understand the nature and purpose of planning
3. To Gain the knowledge about the frame work of organizing
4. To Understand the essence and significance of directing
5. To Recognize the importance of controlling and its outcomes

Course Outcomes: At the end of this course, student will be able to:

1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT-I

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT-II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT-III

Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human

resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT-IV

Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT-V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, “Management”, 10/e., Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, “Management”, 6/e., Pearson Education, 2004.

Suggested Reading:

1. P.C. Tripathy & P.N. Reddy, “Principles of Management”, Tata McGraw Hill, 1999
2. Harold Koontz and Cyril O’Donnell “Principles of Management’’, Tata McGraw Hill, 2017

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18CE M01

ENVIRONMENTAL SCIENCE

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives:

1. To Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. To Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. To Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: At the end of the course, the student should have learnt

1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT – I:

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT – II:

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem,

food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT – III:

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT – IV:

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT – V:

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, "*Introduction to Environmental Science*", B S Publications, **2004**.
2. Suresh K. Dhameja, "*Environmental Studies*", S. K. Kataria& Sons, **2009**.

Suggested Reading:

1. C. S. Rao," *Environmental Pollution Control Engineering*", Wiley, **1991**.
2. S. S. Dara, "*A Text Book of Environmental Chemistry &Pollution Control*", S. Chand Limited, 2006

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18CS C06

BASICS OF DATA STRUCTURES LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIEv	15 Marks
Credits	1

Pre-requisites: Any Programming Language(C)

Course Objectives:

1. Design and construct simple programs by using the concepts of Data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills while improving their practical knowledge in data structures.
4. To strengthen the practical ability to apply suitable data structure for real time applications.

Course Outcomes: The Student will be able to

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implement non-linear data structures such as trees, graphs and its traversal techniques.
4. Implement various kinds of searching, sorting techniques.
5. Develop the suitable data structure for real world problem.

List of Experiments

1. Implementation of operations on arrays.
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of Sorting techniques.
7. Case study like Banking System, Students Marks Management, Canteen Management etc.

Text Books:

1. Brian W Kernighan, Dennis Ritchie, C Programming Language, PH PTR, 2nd Edition.
2. Richard M Reese, Understanding and Using C Pointers,O'Reily , 2013.

Web Links:

https://nptel.ac.in/courses/106102064/

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18EE C12

DIGITAL ELECTRONICS LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To verify Demorgan's Theorem, SOP, POS forms
2. To design and implement Full/Parallel Adders, Subtractors and Magnitude Comparators, multiplexers, de-multiplexers and decoders using logic gates
3. To construct various flip-flops, shift registers and design different counters.

Course outcomes: After completion of this course, the students will be able to:

1. Demonstrate the truth table of various expressions and combinational circuits using logic gates.
2. Design, test and evaluate various combinational circuits such as adders, subtractors, comparators, multiplexers and demultiplexers.
3. Construct flips-flops,
4. Design synchronous and asynchronous counters
5. Apply shift registers in various circuits.

LIST OF EXPERIMENTS

1. Verify
   (a) Demorgan's Theorem for 2 variables.
   (b) The sum-of product and product-of-sum expressions using gates.
2. Design and implement
   (a) Full Adder using basic logic gates.
   (b) Full subtractor using basic logic gates
3. Design and implement 4-bit Parallel Adder/ subtractor using IC 7483.
4. Design and Implementation of 4-bit Magnitude Comparator using IC 7485.
5. Realize
   (a) 4:1 Multiplexer using gates.
   (b) 3-variable function using IC 74151(8:1MUX).
6. Realize 1:8 Demux and 3:8 Decoder using IC74138.

7. Realize the following flip-flops using NAND Gates.
   (a) Clocked SR Flip-Flop
   (b) JK Flip-Flop
8. Realize the following shift registers using IC7474
   (a) SISO (b) SIPO (c) PISO (d) PIPO.
9. Realize the Ring Counter and Johnson Counter using IC7476.
10. Realize the Mod-N Counter using IC7490.
11. Synchronous counters.
12. Asynchronous counters.

Note: At least **TEN** experiments should be conducted in the Semester

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18EE C13

ELECTRICAL MACHINES-I LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course objectives:

1. To understand the practical connections of the machines.
2. To draw the characteristics of different types of generators.
3 To test the DC machines and single phase transformer under different loading conditions for their performance.

Course Outcomes: After completion of this course, students will be able to:

1. Make the connections for DC machines and single phase transformer for their applications.
2. Design the meter ratings for various applications of DC machines and single phase transformer.
3. Control the speed of the DC motor by different methods.
4. Determine the efficiency of the given DC machine and single phase transformer.
5. Test the DC machine and single phase transformer for their performance.

LIST OF EXPERIMENTS

1. OCC and Load characteristics of separately excited DC generator.
2. OCC and load characteristics of DC shunt generator.
3. Load characteristics of DC compound generator.
4. Speed control of DC shunt motor by field control and armature control
5. Swinburne's test on DC shunt machine to predetermine the efficiency of DC shunt machine at any given load
6. Load test on DC shunt motor.
7. Load test on DC series motor.
8. Hopkinson's test on DC shunt machines.
9. Separation of stray losses of DC shunt machine.
10. OC and SC test on single phase transformer.
11. Load test on single phase transformers.
12. Sumpners test on two identical transformers.

Note: At least **TEN** experiments should be conducted in the semester.

18 EG C03

SOFT SKILLS LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The course will introduce the students to:

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: After successful completion of the course the students will be able to :

1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise 1
Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self-confidence and assertiveness, stress management, moral values.
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)
Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)
Exercise 2
Main Topics: Advanced Group Discussion with Case studies : Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

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Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)
Writing Input: Writing with Precision - Writing Abstracts.

Exercise 3
Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions & Practice)
Writing Input: Writing to Reflect - Resume Writing.

Exercise 4
Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity
Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)
Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5
Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)
Writing Input: Writing to Record - Writing minutes of meeting.

Suggested Reading:
1. Madhavi Apte , "**A Course in English communication**", Prentice-Hall of India, 2007
2. Dr. Shalini Verma, **"Body Language- Your Success Mantra**", S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "**The ACE of Soft Skills",** New Delhi: Pearson, 2010
4. Van Emden, Joan, and Lucinda Becker, "**Presentation Skills for Students**", New York: Palgrave Macmillan, 2004
* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:
1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

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AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-V

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC14**	Electrical Machines-II	3	-	-	3	30	70	3
2	**18EEC15**	Power Systems-II	3	-	-	3	30	70	3
3	**18EEC16**	Power Electronics	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective -1	3	-	-	3	30	70	3
5	**18EEEXX**	Core Elective -2	3	-	-	3	30	70	3
6	**18MBC01**	Engineering Economics and Accountant	3	-	-	3	30	70	3
PRACTICALS									
7	**18EEC17**	Electrical Machines-II Lab	-	-	2	2	15	35	1
8	**18EEC18**	Power Systems-I Lab	-	-	2	2	15	35	1
9	**18EEC19**	Power Electronics Lab	-	-	2	2	15	35	1
		Total	**18**	**-**	**6**	**-**	**225**	**525**	**21**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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Course Code	Core Elective-1
18EEE01	Wind and Solar Energy
18EEE02	Optimization Techniques
18EEE03	Electrical Engineering Materials
18EEE04	Electronic Instrumentation

Course Code	Core Elective-2
18EEE05	Simulation Techniques in Electrical Engineering
18EEE06	Energy Conservation & Auditing
18EEE07	Industrial Electrical Systems
18EEE08	Electrical Estimation & Costing

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B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-VI

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC20**	Control Systems	3	-	-	3	30	70	3
2	**18EEC21**	Microprocessors and Microcontrollers	3	-	-	3	30	70	3
3	**18EEC22**	Power Systems Operation and Control	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective-3	3	-	-	3	30	70	3
5	**18EEEXX**	Core Elective-4	3	-	-	3	30	70	3
6	**18XXOYY**	Open Elective-1	3	-	-	3	30	70	3
PRACTICALS									
7	**18EEC23**	Control Systems Lab	-	-	2	2	15	35	1
8	**18EEC24**	Microprocessors Lab	-	-	2	2	15	35	1
		Total	**18**	**-**	**4**	**22**	**210**	**490**	**20**

L: Lecture T: Tutorial P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Core Elective-3
18EEE09	Power Quality
18EEE10	Advanced Power Converters
18EEE11	Electrical Distribution Systems
18EEE12	HVDC Transmission Systems

Course Code	Core Elective-4
18EEE13	AI Techniques In Electrical Engineering
18EEE14	Electric Hybrid Vehicles
18EEE15	FACTS
18EEE16	Special Electrical Machines

Course Code	Open Elective-1
18ECO06	Principles of Embedded Systems (PES)
18CSO07	Basics of Cyber Security (BCS)
18BTO01	Basics of Biology
18PYO01	History of Science and Technology

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V – SEMESTER

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18EEC14 **ELECTRICAL MACHINES-II**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of this course is to:

1. To understand the construction and operational features of ac Machines.
2. To familiarize with performance aspects of Induction Motor, Synchronous Machine.
3. To impart the knowledge of various starting methods and selecting a suitable method based on the application.

Course Outcomes: The student will be able to:

1. Identify the various parts and nomenclature related to ac Machine windings
2. Classify various ac Machines based on constructional and operational features.
3. Associate the concepts with characteristics of ac Machines.
4. Analyze various starting and speed control methods of ac Machine.
5. Sketch and analyze the Characteristics of ac Machine based on application.
6. Determine the performance parameters of ac machines.

UNIT-I

Fundamentals of AC machine windings : Slots for windings, Harmonics (slot and teeth Harmonics), Suppression of Harmonics, full-pitch and short pitch coils, concentrated winding, distributed winding, pitch factor, distribution factor, Integral and fractional slot windings, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, advantages of star connected winding.

UNIT-II

Three phase Induction Machines: Constructional features, types of rotors, production of rotating magnetic field, operation, slip, rotor current and frequency, equivalent circuit, torque expression, starting torque, maximum torque, torque-slip characteristics, parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency), cogging and crawling, power flow, losses and efficiency, no load and blocked rotor test, predetermination of performance characteristics using circle diagram, double cage induction motor, induction generator.

Starting methods: Primary resistors, auto-transformer, star-delta and DOL starting. Speed control methods from stator and rotor side.

UNIT-III

Single-phase Induction Motors: Constructional features double revolving field theory, split phase, shaded pole and capacitor type motors, equivalent circuit, applications.

UNIT-IV

Synchronous Generators: Constructional features, cylindrical and salient pole rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, open circuit, short circuit and zero power factor characteristics, voltage regulation by EMF, MMF and ZPF method, Salient pole alternators two reaction theory, Phasor diagram, power angle characteristics. Parallel operation of alternators, synchronization and load division.

UNIT-V

Synchronous Motor: Theory of Operation, methods of starting, variation of current and power factor with excitation on no-load and on-load, Hunting and its prevention, synchronizing power, synchronous condenser.

Text Books:

1. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.
2. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
3. J.B Gupta, S.K. Kataria & Sons, “Theory and performance of electrical machines”, 14th Edition, 2014.
4. Ashfaq Hussain “Electrical Machines” Dhanapat Rai and sons, 3rd Edition 2012.

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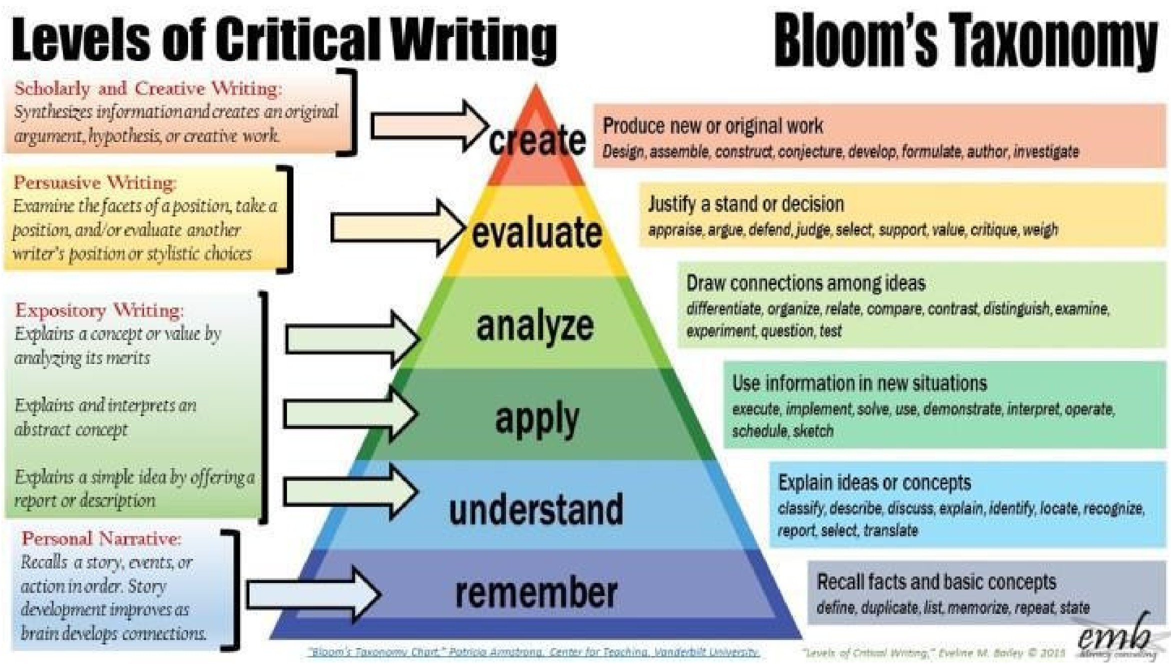
Suggested Readings:

1. A.E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.
5. Juha Pyrhonen, Tapani Jokinen, Valeria Hrabovcova, "Design of Rotating Electrical Machines", John Wiley &Sons, Ltd. 2008.



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18EEC15 **POWER SYSTEMS -II**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of this course is to:
1. To understand the modelling of transmission lines and their performance calculations
2. To understand per unit system representation and calculation of fault currents.
3. To understand the generation of over voltages and power flow analysis of given power system.

Course Outcomes: After completion of this course, students will be able to:
1. Analyse the performance of different types of transmission lines and evaluate the effect of corona on transmission lines
2. Understand the per unit quantities of the given power system
3. Classify different types of faults and apply symmetrical components to solve the power system problem when subjected to different fault conditions
4. Describe the causes of over voltages and analyse reflection and refraction coefficients of overhead lines and cables
5. Apply Gauss Seidel method and Newton-Raphson method to find power flows and voltages of the given power system.

UNIT-I

Modelling of Transmission Lines: Short, medium, long lines, Line calculations, Tuned Lines, Surge impedance loading, Travelling wave equations, series and shunt compensation of Transmission lines
Corona: Causes, Disruptive and Visual Critical Voltages, Power loss, minimization of Corona effects.

UNIT-II

Per Unit System of Representation: Use of per unit quantities in power systems, Advantages of per unitsystem.
Symmetrical Faults: Typical waveform under balanced terminal short circuit conditions: steady state, transientand sub transient equivalent circuits, Reactance of Synchronous Machines, fault calculations, Short circuit capacity of a bus.

UNIT-III

Unsymmetrical Faults: Symmetrical components of unsymmetrical Phasors, Power in terms of symmetricalcomponents, sequence impedance and sequence networks. Sequence networks of unloaded generators, Sequence impedances of circuit elements, Single line to ground, line-to-line and double line to ground faults on unloaded generator, Unsymmetrical faults of power systems.

UNIT-IV

Transients in Power systems: Generation of Over-voltages: Causes of over voltages, lightning and SwitchingSurges, Travelling Wave Theory, Wave equation, Reflection and refraction coefficients, Junction of cable andoverhead lines, Junction of three lines of different natural impedances, Bewley Lattice diagram, Introduction to EMTP.

UNIT-V

Power Flow Analysis: Formation of Bus Admittance Matrix. Real and reactive power balance equations at anode. Load and Generator Specifications. Application of numerical methods for solution of non-linear algebraic equations- Gauss Seidel and Newton-Raphson methods for the solution of the power flow equation.

Text Books:

1. J.J Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.
2. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
3. C.L. Wadhwa, "Electric Power Systems Theory", New Academic Science Limited, 2012

Suggested Reading:

1. A.R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
2. D.P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.
3. B.M. Weedy, B.J. Cory, N. Jenkins, J. Ekanayake & G. Strbac, "Electric Power Systems", Wiley, 2012

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18EEC16 **POWER ELECTRONICS**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objective:
1. To identify the characteristics of different static switches and their turn-ON & turn-OFF methods.
2. To know the principles of AC-DC, DC-DC, DC-AC and AC-AC energy conversions.
3. To study various methods of voltage control in power converters.

Course Outcomes: After the completion of this course, students will be able to:
1. Understand the construction, operation and characteristics of various power semiconducting devices and to identify their selection in appropriate application.
2. Comprehend the driver/trigger circuits for various devices & also protection circuit, different turn-OFF methods, series & parallel operation of SCRs.
3. Illustrate the principle of working of AC-DC, AC-AC, DC-DC & DC-AC converters.
4. Analyse the performance for various power converters with different loads and modes of working.
5. Describe various voltage control techniques in power electronic converters with their applications

UNIT-I

Power Switching Devices: Power diode, characteristics, Recovery characteristics, Types of power diodes, General purpose diodes, Fast recovery diodes, their applications. Bipolar Junction Transistors(BJT), Power MOSFET, IGBT Basic structure and working, Steady state and switching characteristics, Gate drive circuits for MOSFET and IGBT, Comparison of BJT, MOSFET and IGBT, Their applications.

UNIT-II

Silicon Controlled Rectifier (SCR): SCR-Static characteristics, Two transistor analogy, Protection of SCRs, Dynamic characteristics, Series and parallel operation of SCRs, SCR trigger circuits-R, RC and UJT triggering circuits, Commutation methods of SCR.

UNIT-III

Thyristors Rectifiers: Study of Single-phase and three phase half wave and full wave controlled rectifiers with R, RL, RLE loads, significance of freewheeling diode, Effect of source inductance, Dual converters - circulating and non circulating current modes.

UNIT-IV

DC-DC Converters: Principles of Step-down, Step-up, Step UP/Down choppers, Time ratio control and current limit control, Types of choppers Type- A, B, C, D and E, Voltage commutated chopper, Introduction to Buck, Boost and Buck-Boost regulators.

AC-AC Converters: Principle of operation of Single phase step-up and step-down Cyclo-converters and their applications. Single-phase AC Voltage Controllers with R and RL loads

UNIT-V

DC-AC Converters: Principle of operation of Single-phase Bridge inverters, Voltage control methods, Single pulse width modulation, Multiple pulse width modulation, Sinusoidal pulse width modulation, Three-phase bridge Inverters, 180^0 & 120^0 modes of operation, switch states, instantaneous output voltages, average output voltages for single & three phase inverters, Current source inverters, Comparison of Voltage Source Inverters and Current Source Inverters,

Text Books:

1. Singh. M. D, Khanchandani.K. B, “Power Electronics”, Tata McGraw Hill, 2nd Edition, 2017.
2. Rashid. M. H., “Power Electronics Circuits Devices and Applications”, 4th Edition, Pearson India, 2017.
3. Bimbra. P. S, “Power Electronics”, Khanna Publishers, 3rd Edition, 2013.
4. R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science & Business Media, 2013

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Suggested Reading:

1. N. Mohan, T.M. Undeland , “Power Electronics: Converters, Applications and Design”, John Wiley & Sons,2007
2. P.C. Sen, “Power Electronics”, Tata Mc-Graw Hill, 1st Edition, 2001.
3. L.Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009

There are only two mistakes one can make along the road to truth; not going all the way, or not starting at all; not doing anything can be worse than doing the wrong thing.

Vikasa Mantras- Vivekananda Institute of Human Excellence

18EEC17 **ELECTRICAL MACHINES-II LAB**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course objectives:
1. To understand the practical connections of the machines.
2. To calculate the various parameters of induction motor and synchronous machine by performing the experiment.
3. To analyze the performance of the induction motor and synchronous machine by conducting suitable experiments.

Course Outcomes: After the completion of this course, students will be able to:
1. Identify the connections for Induction and synchronous machines for their applications.
2. Control the speed of the induction motor using different methods.
3. Estimate the voltage regulation of alternator by various regulation methods.
4. Illustrate the synchronization of alternator to bus bar.
5. Determine the performance characteristics of induction machines by conducting suitable tests.
6. Analyze the conversion principle employed in Scott connection of transformer.

LIST OF EXPERIMENTS

1. Three-phase to two phase conversion of transformer (Scott connection)
2. Performance characteristics of single-phase induction motor.
3. Speed control of 3 phase induction motor by rotor resistance control and by V/f control method.
4. No- load test of slip ring induction motor to determine the relationship between
   i) Applied voltage and speed, ii) Applied voltage and rotor current, iii) Applied voltage and stator current,
   iv) Applied voltage and power factor, v) Applied voltage and power input.
5. No-load test, blocked rotor test and load test on 3-phase squirrel cage Induction motor.
6. Power factor improvement of induction motor using capacitors.
7. Line excited induction generator characteristics.
8. Voltage regulation of alternator by i) Synchronous impedance method ii) Ampere-turn method.
9. Voltage regulation of alternator by zero power factor method.
10. Measurement of Xd and Xq of 3 phase salient pole synchronous machine by conducting slip test.
11. Synchronization of three-phase alternator to bus bar using dark lamp method.
12. Variation in the active and reactive power of an alternator connected to an infinite bus by
    i) Varying excitation, ii) Varying mechanical-power input.
13. Separation of core losses in a single-phase transformer.

Note: At least **TEN** experiments should be conducted in the semester.

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18EEC18 **POWER SYSTEMS-I LAB**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:
1. To understand the working of Generating Stations and calculations of line parameters
2. To determine regulation & efficiency of short, medium and long transmission lines and to calculate A, B, C, D constants and study Ferranti effect in long lines.
3. To calculate the sequence impedance of alternator and transformer

Course Outcomes: After completion of the course, students will be able to:
1. Analyze the working of various parts of Generating Station.
2. Experiment with string of insulators and 3 core cables.
3. Determine the dielectric strength of oil.
4. Evaluate the Line Constants, ABCD constants, regulation and efficiency of a transmission line.
5. Calculate the sequence parameters of the transformer and alternator.

LIST OF EXPERIMENTS

1. Visiting nearby Generating Plant and submitting the report.
2. Line Constants determination of 3-Phase Transmission Line.
3. Determination of Voltage distribution and String efficiency of string of Insulators.
4. Measurement of capacitance of 3-core cables.
5. Determination of dielectric strength of transformer oil & Study of Megger.
6. Evaluate the Power Factor Improvement methods in 3-Phase Transmission Line.
7. Determination of A, B, C, D constants of 1-Phase transmission line.
8. Determination of regulation & efficiency of 3-Phase transmission line.
9. Study of Series- shunt compensation of a long transmission line.
10. Design of Static excitation system of Synchronous Generator.
11. Determination of Synchronous machine reactance and time constant from 3-Phase S.C test.
12. Determination of Sequence impedance of 3-Phase Alternators by fault Analysis.
13. Determination of positive, negative and zero-sequence impedance of 3 -Phase transformers.

Note: At least **TEN** experiments should be completed in the semester

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18EEC19 **POWER ELECTRONICS LAB**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To obtain and plot the characteristics of different static switches.
2. To analyze the triggering and commutation circuits for SCR.
3. To familiarize and simulate the conversion principles of AC-DC, DC-DC, DC-AC and AC-AC conversion circuits.

Course Outcomes: After completion of the course, students will be able to:

1. Plot the characteristics of various controlled switches and identifies effect of variation of control signal on the regions of switching operation.
2. Demonstrate the effect of delay angle and nature of load on the performance of various power converters and able to plot the output voltage and current waveforms.
3. Simulate various types of power converters and discriminate between simulation models and practical models of various power converters.
4. Understand various voltage control techniques in different power converters.
5. Select proper equipment, precautions, implement connections keeping technical, safety and economic issues.

List of Experiments

PART-A

1. Study of static characteristics of S.C.R. and to measure latching & holding currents.
2. Study the characteristics of BJT, MOSFET and IGBT.
3. R, RC and UJT triggering circuits for SCR
4. Study of forced commutation techniques of SCR.
5. Single phase half-controlled bridge rectifier with R and RL loads.
6. Single phase fully controlled converter with R and RL loads and freewheeling diode
7. Single phase full converter as a controlled rectifier and inverter.
8. Three phase half-controlled bridge rectifier with R and RL loads.
9. Three phase fully controlled bridge rectifier with R and RL loads.
10. DC voltage control using Buck and Boost choppers.
11. Voltage commutated chopper with R&RL loads
12. Current commutated chopper with R&RL loads.
13. Single phase step down Cyclo converter with Rand RL loads.
14. Single phase A.C voltage controller with R and RL loads
15. Half and Full bridge inverters with R&RL loads.

PART-B

1. Simulation of Single-Phase Full converter and Semi converter with R & RL loads and freewheeling diode.
2. Simulation of Three Phase Full converter and Semi converter with R & RL loads.
3. Simulation of Single-phase AC voltage controller with R & RL loads
4. Simulation of single phase Cyclo converter with R & RL loads.
5. Simulation of single-phase half-bridge & full-bridge inverters.
6. Simulation of three phase bridge inverter in different modes.
7. Simulation of Single Phase Inverter with single, multiple and sinusoidal pulse width modulations.

Note: At least **SEVEN** experiments from PART-A and **THREE** from PART-B should be conducted in the semester.

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18EEE01 WIND AND SOLAR ENERGY SYSTEMS (Core Elective - 1)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. To familiarize Non-Conventional energy sources for sustainable energy conversion.
2. To understand working of wind power generation and wind energy conversion systems.
3. To understand the working of solar energy systems and Explore the issues with integration of renewable energy sources.

Course Outcomes: After the completion of this course, students will be able to:

1. Understanding the significance of non-conventional energy sources
2. Apply the knowledge of physical requirement of wind power energy systems
3. Analyze the required parameters for generator, turbine and converter suitable for a specific wind-generation topology.
4. Understand solar thermal systems
5. Analyze the network integration issues

UNIT-I:

Fundamentals of Energy: Introduction, Classification of energy resources, importance of Non Conventional Energy Sources, Common forms of energy, Merits and Demerits of non-conventional energy sources over conventional energy sources.

UNIT-II

Physics of Wind Power: History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions. Review of modern wind turbine technologies, Fixed and Variable speed wind turbines.

UNIT-III

Wind generator topologies: Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters, Generator-Converter configurations, Converter Control, Wind farm behavior during grid disturbances, Power quality issues, Power system interconnection experiences in the world, Hybrid and isolated operations of wind systems.

UNIT-IV

The Solar Resource: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability. Peak Sun Hours (PSH) at a location

Solar photovoltaic: Technologies-Amorphous, mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Maximum Power Point Tracking (MPPT) algorithms, Balance of System Components, Solar PV Systems, Solar PV Applications

Solar Thermal Systems: Introduction, Solar Collectors, Solar Water Heater, Solar Passive Space Heating and Cooling Systems, Solar Industrial Heating Systems, Solar Refrigeration and Air Conditioning Systems, Solar Cookers

UNIT-V

Network Integration Issues: Overview of grid code technical requirements, Fault ride-through for wind farms -real and reactive power regulation, voltage and frequency operating limits.

Text Books:

1. T. Ackermann, “Wind Power in Power Systems”, John Wiley and Sons Ltd., 2005
2. G. M. Masters, “Renewable and Efficient Electric Power Systems”, John Wiley and Sons, 2004.
3. S. P. Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, McGraw Hill, 1984.

Suggested Reading:

1. H. Siegfried and R. Waddington, “Grid integration of wind energy conversion systems” John Wiley and Sons Ltd., 2006
2. G. N. Tiwari and M. K. Ghosal, “Renewable Energy Applications”, Narosa Publications, 2004
3. J. A. Duffie & W.A. Beckman, “Solar Engineering of Thermal Processes”, John Wiley & Son

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18EEE02 OPTIMIZATION TECHNIQUES (Core Elective - 1)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To study about classical optimization techniques which include single variable and multi-variable optimization with equality constraints
2. To study about linear programming and non-linear programming methods
3. To study about Genetic algorithms.

Course Outcomes: After completion of the course, students will be able to:

1. Solve the single variable and multi variable problems with and without constraints using classical optimization techniques
2. Determine the solution of linear programming problem using graphical method, simplex algorithm and revised simplex algorithm
3. Calculate the optimum of a nonlinear function using various elimination and search methods
4. Analyze Steepest Descent, Conjugate Gradient, Newton method, David-Fletcher-Powell methods in finding the optimum of given non linear function
5. Discuss the operators, selection techniques in genetic algorithm and apply the genetic algorithm to economic load dispatch problem

UNIT- I

Introduction: Classical optimization techniques: Statement of optimization problem, Objective function, Classification of optimization problems, Single-variable & Multi-variable Optimization without constraints. Multi-variable optimization with equality Constraints, Lagrange multiplier method, Multi-variable optimization with inequality constraints, Kuhn- Tucker conditions

UNIT- II

Linear Programming: Standard form, Formulation of the LPP, Solution of simultaneous equations by Pivotalcondensation, Graphical method, Simplex algorithm, Revised simplex method

UNIT- III

Non-Linear Programming-I: Unimodal function, Elimination methods: Fibonacci method, Golden Sectionmethod.

Direct Search methods: Univariate Search method, Hook and Jeeve's method, Powell's method.

UNIT- IV

Non-Linear Programming-II:

Gradient methods: Steepest Descent, Conjugate Gradient, Newton method, David-Fletcher-Powell method

UNIT-V

Genetic Algorithms: Introduction, Encoding, Fitness Function, Basic Operators, Single Point cross over, two-**point** cross over, uniforms cross over, mutation operator, Selection Techniques, Tournament Selection, Roulette wheel selection.

Text Books:

1. S.S.Rao, "Engineering Optimization Theory and Applications", New Age International, 3rd Enlarged Edition(in two colour), 2013
2. Jasbir S. Arora, "Introduction to Optimum Design", Academic Press, 4th Edition, 2016

Suggested Reading:

1. Kalyamoy, Deb, "Multi Objective Optimization using Evolutionary Algorithms", Wiley publications, 2013.
2. S. Rajasekharam, G.A. Vijaya Lakshmi, "Neural networks, Fuzzy logic and Genetic Algorithms Synthesis and Applications", PHI publications, 2010

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18EEE03 **ELECTRICAL ENGINEERING MATERIALS (Core Elective -1)**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To study the conducting, insulating and magnetic properties of different materials
2. To know the optical properties for materials.
3. To categorize the materials used for Direct Energy Conversion

Course Outcomes: After the completion of this course, students will be able to
1. Classify the given conducting material based on its properties
2. Understand and select proper insulating material in the field of Electrical engineering
3. Investigate the suitability of material for the latest technological requirement
4. Select a suitable material for optical applications.
5. Illustrate the materials used in Direct Energy Conversion Devices.

UNIT- I
Conducting Materials: Electrical conducting Materials, High conductivity materials, Materials of High Resistivity, Materials used for precision work, rheostats, heating devices, Super conductivity, Special types of alloys, Applications &Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI).

UNIT -II
Insulating Materials: Classification of Insulting materials, temperature rise, electrical properties of insulating materials used for wires-laminations- machines and their applications, Ceramics, Plastics, DC electrical properties, AC electrical properties, Dielectric properties of insulators, Dielectric materials used for various electrical applications, suitability.

UNIT- III
Magnetic Materials: Magnetic parameters, the three types of magnetic material, measuring of magnetic parameters, Application of soft magnetic materials, Magnetic recording media, Hard (permanent) magnets, Ferrites, Samarium, Cobalt alloys, Neodymium Iron Boron (Nd Fe B).

UNIT- IV
Optical Properties of Materials: EM Radiation Spectrum, Optical properties in materials, Photo electric emission, Photo conductivity, Lasers, Optical fibres, fibre cables.

UNIT –V
Materials for Direct Energy Conversion Devices: Solar cells, equivalent circuit of a solar cell, fuel cell, MHD generators, storage of hydrogen, thermoelectric generators, Nano applications in Electrical Engineering.

Text Books:

1. G.K Benarjee, "Electrical and Electronic Engineering Materials", PHI, 2015
2. Ian P. Jones, "Material Science for Electrical and Electronic Engineers", Oxford University Press, 2008.
3. R. K Sukhla, "Electrical Engineering Materials", McGraw Hill Education, 2013.

Suggested Reading:

1. Dhir, "Electronic Components & Materials", McGraw Hill Education,2012.
2. "Electrical Engineering Materials", McGraw Hill Education, TTTI Madras, 2004.

18EEE04 ELECTRONIC INSTRUMENTATION (Core Elective - 1)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To impart basic knowledge of International Standards for various physical quantities and understanding of measurement systems.
2. To familiarize with many varieties of transducers, measuring instruments, their construction and operating principles.
3. To introduce various types of spectrum analyzers, digital instrumentation with design and also an exposure to some of the prominent bio-medical Instrumentation systems.

Course Outcomes: After the completion of this course, students will be able to:

1. Understand the various standards available for the measurement process.
2. Acquire knowledge on various transducers with the analysis in their working principles.
3. Select an electrical transducer for a given physical quantity measurement.
4. Identify instruments like spectrum analyzer, DSO and other virtual instrumentation techniques such as SCADA for appropriate measurements.
5. Illustrate the applications of various Bio-medical instruments used in healthcare.

UNIT– I

Introduction to Instrumentation: Accuracy and Precision - Conformity and Significant figures, Resolution and Sensitivity, Types of Errors, Loading effect, Absolute errors and Relative errors, Measurement of error combinations, Statistical analysis, Probable error and Limiting errors, Calibration, IEEE standards, Elements of ISO 9001, Quality management standards.

UNIT–II

Transducers-I: Classification of transducers, factors for selection of a transducer, Passive electrical transducers: Strain gauges - gauge factor, types of strain gauges - bonded and un-bonded, rosettes, LVDT-construction and displacement measurement, Capacitive transducer and thickness measurement. Active electrical transducers: Piezo-electric transducer and different modes of operation, photo-conductive, photo-voltaic and photo - emissive transducers, semiconductor stain gauges.

UNIT–III

Transducers-II: Characteristics of sound, pressure, power and intensity levels. Microphones and their types. Temperature measurement, resistance wire thermometers, semiconductor thermometers and thermocouples. Introduction to Micro-Electro-Mechanical Systems (MEMS)

UNIT – IV

Digital Instruments: Block diagram, specification and design considerations of different types of DVMs. Spectrum analyzers. Delayed time base oscilloscope, Digital storage oscilloscope. Introduction to Virtual Instrumentation, SCADA. Data Acquisition System- block diagram

UNIT–V

Applications of Instrumentation: Human physiological systems and related concepts. Bio-potential electrodes Bio-potential recorders - ECG, EEG, EMG and CT scanners, magnetic resonance and imaging systems, Ultrasonic Imaging systems.

Text Books:

1. Albert D. Helfric, and William D. Cooper, “Modern Electronic Instrumentation and Measurement Techniques”, PHI, Jan-2015
2. H S Kalsi, “Electronic Instrumentation”, 3/e, TMH, July-2017
3. Nakra B.C, and Chaudhry K.K., “Instrumentation, Measurement and Analysis”, TMH, Dec-2017

Suggested Readings:

1. David A. Bell, “Electronic Instrumentation & Measurements” PHI, 2nd Edition, 2003.
2. Khandpur. R.S., “Handbook of Bio-Medical Instrumentation”, TMH, 2003.
3. Leslie Cromwell and F.J. Weibell, E.A. Pfeiffer, “Biomedical Instrumentation and Measurements”, PHI, 2nd Ed, 1980.

18EEE05 SIMULATION TECHNIQUES FOR ELECTRICAL ENGINEERING (Core Elective-2)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To introduce basics of MATLAB and PSpice
2. To build knowledge about matrices and plots
3. To introduce various simulation techniques and computational methods using MATLAB and PSpice

Course Outcomes: After completion of the course, students will be able to:
1. Understand basic syntax of MATLAB and PSpice programming
2. Apply matrix mathematics, plots and functions for solving and visualization of the numerical solution
3. Determine DC, AC and transient analysis in PSpice environment
4. Design modelling parameters of Diode, BJT, MOSFET, IGBT and SCR
5. Analyse the response of uncontrolled and controlled rectifiers with different controlled parameters and loads

UNIT-I
Basics: MATLAB environment, variables, Basic data types, Relational and Logic operators, Conditional statements, Input and Output, Loops and bracing.

UNIT-II
Matrices: Creating and Manipulating matrices, Matrix mathematics and Matrix functions, Colon operator, Line space, Cross product, Dot product, Logical functions, Logical indexing, 3 – dimensional arrays, Cell arrays, Structures, Plotting: 2-D and 3-D plots: Basic plots, subplots, Histograms, Bar graphs, Pie charts.

UNIT-III
M –file Scripts: Creating saving and running an M–file, creating and running of a function, function definition line, H1 and help text lines, Function body, Sub – functions, File I/O handling

UNIT-IV
PSpice for Circuit Analysis: Introduction to PSpice, Description of circuit elements, nodes and sources, input and output variables, modelling of the above elements, types of DC analysis, types of AC analysis and Transient Analysis.

UNIT-V
PSpice for Electronic Devices and Circuits: Diode model, BJT model, MOSFET model, IGBT model, SCR model, Sub routines, diode rectifiers, controlled rectifiers.

Text Books:

1. Muhammad H. Rashid, "Power Electronics: Circuits, Devices, and Applications", Pearson Education India. 3rd Edition, 2009.
2. D Hanselman and B little field, "Mastering MATLAB 7", Pearson Education, 2005.
3. Y Kirani Singh and B B Chaudhari, "MATLAB Programming", Prentice Hall of India, 2007.

Suggested Reading:

1. Muhammad H. Rashid, "Spice for Power Electronics and Electric Power", CRC Press 3rd Edition, 2012.
2. A Gilat, "MATLAB: An Introduction with Applications", John Wiley and Sons, 2004

18EEE06 **ENERGY CONSERVATION AND AUDITING (Core Elective-2)**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:
1. To know the concept of energy conservation and auditing
2. To understand the formulation of efficiency for various electrical systems
3. To explore the different ways to design various technologies for efficient electrical systems.

Course Outcomes: After the completion of this course, students will be able to:
1. Understand about current energy scenario and importance of energy conservation
2. Apply the concepts of energy management
3. Analyze the performance of existing electrical and industrial systems
4. Understand different energy efficient systems in electrical and industrial systems
5. Apply the energy efficiency techniques in electrical systems

UNIT-I:
Energy Management & Audit: Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future.

UNIT-II:
Basics of Energy and its various forms: Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT-III
Energy Efficiency in Electrical Systems: Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

UNIT-IV
Energy Efficiency in Industrial Systems: Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers (elementary treatment)

UNIT-V
Energy Efficient Technologies in Electrical Systems: controllers, energy efficient motors, soft starters with Maximum demand controllers, automatic power factor energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

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Text Books:

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online)

Suggested Reading:

1. S. C. Tripathy, “Utilization of Electrical Energy and Conservation”, McGraw Hill, 1991
2. Y. P. Abbi, Energy Audit: Thermal Power, Combined Cycle, and Cogeneration Plants, The Energy and Resources Institute, 2012, ISBN 978-81-7993-311-4
3. Tarik Al-Shemmeri, "Energy Audits: A Workbook for Energy Management in Buildings", August 2011.
4. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

If we have built castles in the air, our work need not be lost; that is where they should be. Now lay the foundation under them. But a fool is one who, having no goal, redoubles his efforts.

Vikasa Mantras- Vivekananda Institute of Human Excellence

18EEE07 INDUSTRIAL ELECTRICAL SYSTEMS (Core Elective-2)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. Understand various components of industrial electrical systems and analyze and select the proper size of various electrical system components.
2. Understand the electrical wiring systems for residential and commercial consumers and analyze and select the proper size of various electrical system components.
3. Understand necessity of illumination for specified requirement

Course Outcomes: After completion of this course, students will able to:
1. Understand various components of industrial electrical systems
2. Apply residential and commercial electrical wiring rules and guidelines for installation of electrical systems
3. Design various Illumination schemes and lighting systems
4. Understand HT connection, Industrial loads and LT panel components
5. Select the proper size of various electrical system components

UNIT-I

Electrical System Components: LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, single line diagram (SLD) of a wiring system, Electric shock and Electrical safety practices (Elementary treatment only)

UNIT-II

Residential and Commercial Electrical Systems: Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components. (Elementary treatment only)

UNIT-III

Illumination Systems: Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting. (Elementary treatment only)

UNIT-IV

Industrial Electrical Systems I: HT connection, industrial substation, Transformer selection, Industrial loads, Earthing design, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components. (Elementary treatment only)

UNIT-V

Industrial Electrical Systems II: DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS & Battery Banks. (Elementary treatment only)

Text Books:

1. S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating & Costing”, Khanna publishers, 2008.
2. K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 2007.

Suggested Readings:

1. S. Singh and R. D. Singh, “Electrical estimating and costing”, Dhanpat Rai and Co., 1997.
2. H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2008.
3. Hemant Joshi "Residential, Commercial and Industrial Electrical Systems: Equipment and selection Volume 1 of Residential, Commercial and Industrial Electrical Systems", Tata McGraw-Hill Education, 2008

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18EEE08 **ELECTRICAL ESTIMATION AND COSTING (Core Elective-2)**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To emphasize the estimation and costing aspects of all electrical equipment, installation and designs on the cost viability.
2. To Estimate the Bill of Materials for Residential and commercial installations
3. To design overhead transmission and distribution lines, substations and illumination schemes

Course Outcomes: After completion of this course, student will be able to:
1. Define the principles related to electrical wiring and costing.
2. Summarize the electrical specifications of residential building and electrification requirements.
3. Distinguish between Residential and Commercial Installations.
4. Estimate the materials required to Design Electrical Installation of Substation, Transmission and Distribution Systems.
5. Identify and Design the various types of light sources for different applications.

UNIT-I

Electrical Wiring: Different types of wires, wiring system and wiring methods, Comparison of different types of wirings. Specifications of Different types of wiring materials, Accessories Different types of wiring appliances and tools. Domestic and industrial panel wiring. Different types of wiring circuits. I.E. rules for wiring, Electricity supply act-1948.

Principles of Costing: Purpose of Estimating and Costing, Recording of Estimates, Determination of Cost Material and Labour, Over Head Charges, Profit, Purchase System, Payment of Bills, Tender Forms

UNIT-II

Residential Building Electrification: General Rules, guidelines for wiring of residential installation and positioning of equipment**,** Principles of circuit design in lighting and power circuits Procedures for designing the circuits and deciding the number of circuits, Method of drawing single line diagram. Selection of type of wiring and rating of wires and cables Load calculations and selection of size of conductor, Selection of rating of main switch Distribution board, protective switchgear ELCB,MCCB and MCB and wiring accessories, Earthing of residential Installation.

UNIT-III

Electrification of Commercial Installation: Concept of commercial Installation, Differentiate between electrification of residential and commercial installation, Fundamental and Design considerations of electrical Installation system for commercial Building Load calculation and selection of size of service connection and nature of supply, Deciding the size of the cables, bus bar and bus bar chambers, Mounting arrangements and positioning of switchboards, distribution boards main switch etc, Earthing of the electrical installation, Selection of Earth wire, wiring system and layout.

UNIT-IV

Design and Estimation Of Overhead Transmission & Distribution Lines: Introduction, Typical AC electrical power system, Main components of overhead lines, Factors governing height of pole, Conductor materials, Determination of size of conductor for overhead transmission line, Cross arms, Guys and Stays, Conductors configuration spacing and clearances, Span lengths, Overhead line insulators, Lightning Arrestors, Phase plates, Danger plates, Anti climbing devices, Bird guards, Beads of jumpers. Points to be considered at the time of erection of overhead lines, Erection of supports, setting of stays, fixing of cross arms, fixing of insulators, Conductor erection, Repairing and jointing of conductor, Dead end clamps, Positioning of conductors and attachment to insulators Jumpers, Tee-offs, Earthing of transmission lines. Guarding of overhead lines, Clearances of conductor from ground Spacing between conductors, Testing and commissioning of overhead distribution lines.

UNIT-V

Design and Estimation of Substations: Introduction, Types of substations, Outdoor substation – Pole mounted type, Indoor substations – Floor mounted type.

Design and Estimation of Illumination Schemes: Introduction, Terminology in illumination, laws of illumination, various types of light sources, estimation and costing of lighting schemes.

Text Books:

1. "K. B. Raina, S. K. Bhattacharya", "Electrical Design Estimating and Costing", New Age International Publisher, 2010
2. "Gupta J. B., Katson, Ludhiana", "Electrical Installation, estimating and costing", S. K. Kataria and sons, 2013
3. "Surjit Singh", "Electrical Estimation and Costing". Dhanpatrai & Co. second edition, 2001.

Suggested Readings:

1. Code of practice for Electrical wiring installations (System voltage not exceeding 650 volts), Indian Standard Institution, IS: 732-1983.
2. Guide for Electrical layout in residential buildings, Indian Standard Institution, IS: 4648-1968.
3. Electrical Installation buildings Indian Standard Institution, IS: 2032

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18EEC20 **CONTROL SYSTEMS**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To understand different types of linear control systems and their mathematical modeling.
2. To study the stability analysis both in time and frequency domains.
3. To study the concepts of State space representation of Linear Time invariant systems (LTI).

Course Outcomes: After the completion of this course, students will be able to:
1. Understand different mathematical models for any electromechanical LTI systems.
2. Analyze the given first and second order systems based on their performance parameters.
3. Analyze absolute and relative stability of an LTI system using time and frequency domain techniques.
4. Analyze the effects of controller on a given system and to understand the concepts of compensators.
5. Develop various state space models for LTI systems and to check the concepts of Controllability and Observability.

UNIT-I
Introduction to control Systems: Open loop, closed loop System with illustrations and other classification of control systems, Impulse response and Transfer Function, Mathematical modeling of Mechanical and Electrical Systems, Analogous systems, Feedback control characteristics - effects of feedback, D.C & A.C servo motors, Synchro pair as an error detector, Block diagram algebra, Signal flow graphs and problems on conversion from block diagram to signal flow graph.

UNIT-II
Time Response Analysis: Standard test signals, Time response of first and second order systems for standard test inputs, Application of initial and final value theorem, Static error coefficients and steady state error (for standard test input signals) Design specifications for second-order systems based on the time-response.
Concept of Stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique, Construction of Root-loci.

UNIT-III
Frequency-response analysis: Design specifications in frequency-domain, Relationship between time and frequency response, bode plots, Polar plots, Nyquist stability criterion, Relative stability using Nyquist criterion . Stability analysis of plots based on gain and phase margin.

UNIT-IV
Introduction to Controllers and Compensators:
Introduction to Proportional, Integral and Derivative, Proportional plus derivative, Proportional plus integral, Proportional plus integral plus derivative controllers, Introduction to Lead, Lag, Lead-lag and Lag-lead compensators.

UNIT-V
State variable Analysis and Nonlinear systems: Concepts of state variables, State space model, Diagonalization of State Matrix, State transition matrix and its properties, Solution of state equations, Eigenvalues and Stability Analysis, Concept of controllability and observability. Introduction to non-linear systems with suitable examples.

Text Books:

1. I.J. Nagrath, M. Gopal, Control System Engineering, New Age International (P) Limited Publishers, 5th Edition, 2008.
2. B.C. Kuo, Automatic Control Systems, John Wiley and son's Publishers, 9th edition, 2009
3. K. Ogata, Modern Control Systems, 5th Edition.PHI publication, 2010.
4. A. Anand Kumar, Control Systems, 2nd Edition, PHI publications, 2014.

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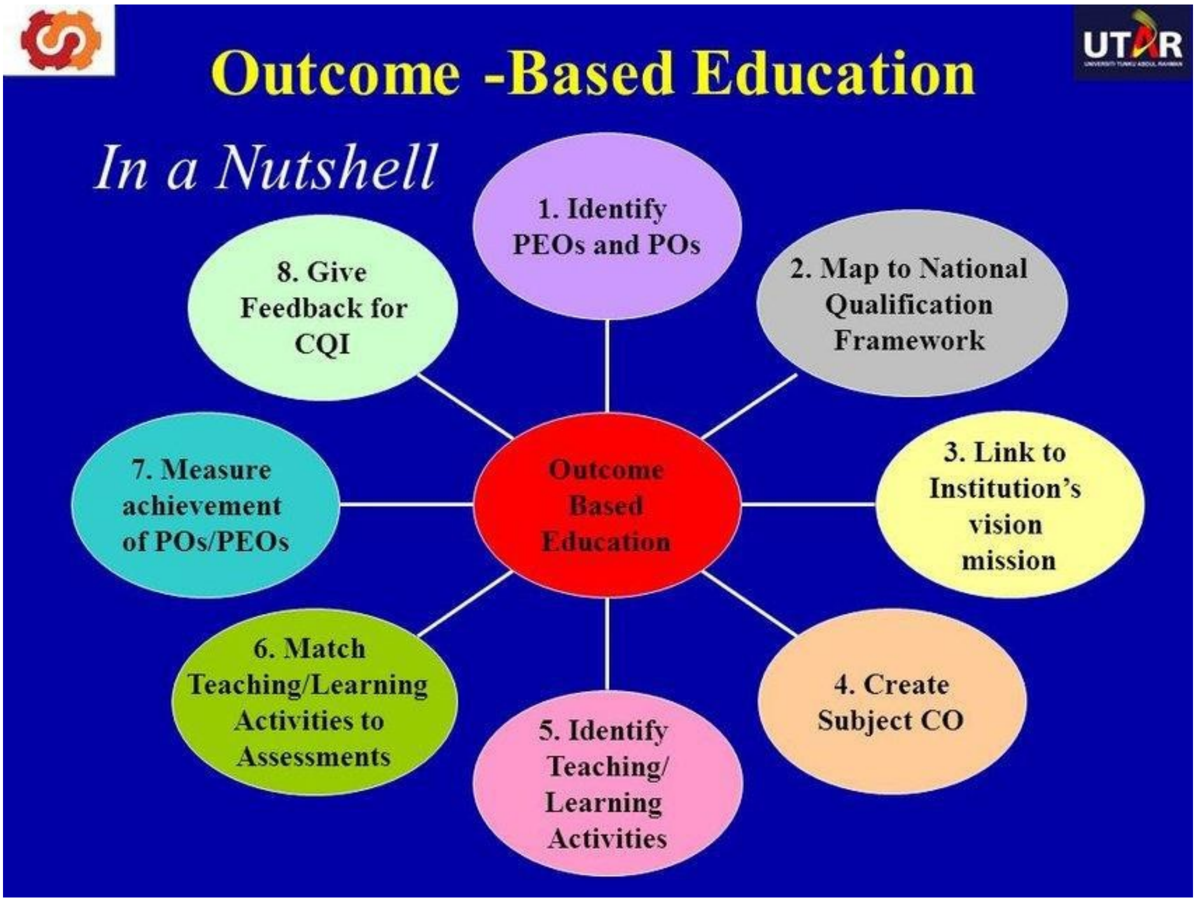
Suggested Readings:

1. M.Gopal, Control Systems Principles and Design- Tata McGraw Hill, 2nd Edition, 2003.
2. N.C Jagan-control Systems, 2^{nd} Edition, BS Publications, 2008
3. N. Nise, Control Systems Engineering, 6^{th} edition, Willey Publications, 2011



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18EEC21 MICROPROCESSORS AND MICROCONTROLLERS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To familiarise the fundamental concepts and Internal functions of microcontrollers & Embedded Systems
2. To demonstrate Programming using 8051 Microcontroller.
3. To illustrate interfacing of 8051 Microcontroller to external devices and various communication protocols.

Course Outcomes: After the completion of this course, students will be able to:

1. Understand the basic concepts of Microcontrollers and Embedded Systems
2. describe the architecture and different modes of operations of 8051 Microcontroller
3. Apply knowledge of instruction set and addressing modes for writing Assembly Language Programming using 8051 Microcontroller.
4. Develop application circuits by interfacing peripherals like A/D, D/A, display and motors to 8051 Microcontroller.
5. Develop Systems using 8051 Microcontroller with the help of Communication Protocols like blue-tooth.

UNIT- I

Fundamentals of Microprocessors: Fundamentals of Microprocessor, Basic Block Diagrams of Microprocessor and Microcontroller, Comparison of 8-bit Microcontrollers, 16-bit and 32-bit Microcontrollers. Role of Microcontrollers in IoT.

UNIT- II

The 8051 Architecture: Internal Block Diagram, Pin diagram CPU, ALU, address, data and control bus, working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, timers, counters Memory Structures, Data and Program Memory.

UNIT-III

Instruction Set and Programming: Introduction, Instruction syntax, Data types, Subroutines Addressing Modes. 8051 Instruction set, Instruction timings.. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools.

UNIT-IV

Memory and I/O Interfacing 6 Hours): Memory and I/O expansion. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, memory devices. LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing

UNIT-V

External Communication and Introduction to embedded systems: Synchronous and Asynchronous Communication. RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee. Definition of embedded system and its characteristics, Role of Microcontrollers in embedded Systems. Functional building block of embedded system, Characteristics of embedded system applications.

Text Books:

1. M. A. Mazidi, J. G. Mazidi and R. D. McKinlay, “The8051Microcontroller and Embedded Systems: Using Assembly and C”, Pearson Education, 2007.
2. K. J. Ayala, “8051 Microcontroller”, Delmar Cengage Learning,2004.
3. D. V. Hall, “Microprocessors & Interfacing”, McGraw Hill Higher Education, 1991.

Suggested Readings:

1. R. Kamal, “Embedded System”, McGraw Hill Education,2009.
2. R. Kamal, “Embedded System”, McGraw Hill Education,2009.
3. R. S. Gaonkar, “Microprocessor Architecture: Programming and Applications with the 8085”, Penram International Publishing, 1996.

18EEC22 POWER SYSTEM OPERATION AND CONTROL

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To understand the importance of Economic Operation and load frequency control of Power Systems
2. To understand the power system stability concepts
3. To get the knowledge of power system security and State Estimation

Course Outcomes: After completion of the course, students will be able to:
1. Determine the equal incremental cost with and without transmission losses and Bmn coefficients
2. Analyze the performance of primary Load frequency control loop and automatic voltage regulator loop
3. Calculate the steady state stability limit and transient stability when the synchronous machine connected to infinite bus is subjected to three-phase fault using Equal area criterion and step by step method.
4. Perform Security Analysis and Contingency Analysis for different Outage Conditions.
5. Elaborate different State Estimation techniques in Power Systems.

UNIT-I

Economic Operation of Power System: Input-Output curves, Heat rates and incremental cost curves, Equal Incremental cost criterion Neglecting transmission losses with and without generator limits, Bmn Coefficients, Economic operation including transmission losses.

UNIT-II

Control of Frequency and Voltage: Speed governor characteristics, turbine model, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control, single area, two area, Generation and absorption of reactive power by various components of a Power System. Automatic Voltage Regulators.

UNIT-III

Stability Constraints in Synchronous Grids: Power System Stability: Definitions Steady state stability and Transient stability, Steady state stability of a synchronous machine connected to infinite bus, calculation of steady state stability limit, Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three phase fault. Analysis using numerical integration of swing equations as well as the Equal Area Criterion.

UNIT-IV

Power System Security: Introduction, Factors Affecting Power System Security, Contingency Analysis: Detection of Network Problems, An overview of Security Analysis, Linear Sensitivity Factors, AC Power Flow Methods, Contingency Selection, Concentric Relaxation, Bounding

UNIT-V

State Estimation in Power System: Power System State Estimation, Weighted Least Square State Estimation: maximum likelihood concepts, matrix formulation, State Estimation of an AC Network, State Estimation by Orthogonal Decomposition, detection and identification of bad measurements, Network Observability and pseudo-measurements

Text Books:
1. I. J. Nagrath& D.P. Kothari, Modern Power System Analysis,4th Edition TMH Publication,2011
2. Allen J. Wood, Bruce.F.Woolenberg,Power Generation, Operation & Control, Wiley Publishers, 2006

Suggested Reading:
1. O. Elgard, Electric Energy Systems Theory, 2nd Edition. TMH Publication,2001
2. A. R. Bergen and V. Vittal, “Power System Analysis”, Pearson Education Inc., 1999.
3. CL Wadhwa, Electrical Power Systems, 3rd Edition New Age International Publications, 2014

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18EEC23 **CONTROL SYSTEMS LAB**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:
1. To understand the characteristics of DC, AC Servo Motors, synchro pair and the frequency response of compensating networks.
2. To study the closed loop performance for given plant using i) P, PI and PID controllers, ii) ON/OFF controller.
3. To perform Simulation studies on for linear time invariant systems

Course Outcomes: After the completion of this course, students will be able to:
1. Demonstrate the characteristics of DC, AC Servo motors and Synchro pair.
2. Analyze the performance parameters for a given second order plant both in time and frequency domain.
3. Analyze the performance of different compensators through frequency response .
4. Design P, PI, PID and ON/OFF controller for a given system and to distinguish the merits and demerits of these controllers.
5. Apply different stability techniques for linear time invariant systems using simulation and then verify with the theoretical calculations

LIST OF EXPERIMENTS

Part A

1. Characteristics of D.C Servo motor.
2. Characteristics of A.C. Servo motor.
3. Characteristics of Synchro Pair.
4. Performance parameters of a second order system excited with step input for different damping ratios.
5. Frequency response of lag and lead compensating networks.
6. Performance of a temperature control system using P, PI and PID Controllers.
7. Temperature control of a system using relay (ON/OFF Control).
8. a) Characteristics of magnetic amplifier for series and parallel connections with different values of resistive load.
   b) Measurement of Step angle for Stepper motor.
9. Find the response of different components of a control system using Linear System Simulator.
10. Demonstration of damping effect on the plant using DC Position Control system.

Part B

1. Stability Analysis (Root locus, Bode and Nyquist) for Linear Time Invariant systems.
2. a) Time Domain specifications for a second order system.
   b) Frequency Domain specifications for a second order system.
3. State space model for a given classical transfer function and its verification.
4. Design and analyze different compensators (lag, lead and lag-lead).

Note: At least **EIGHT** Experiments from **Part A** and **TWO** from **Part B** should be conducted in the semester.

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18EEC24 **MICROCONTROLLERS AND ITS APPLICATIONS LAB**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:
1. To explain instruction set of 8051 microcontroller
2. To demonstrate assembly language programming using 8051 microcontroller
3. To illustrate programming 8051 microcontroller with 'embedded C' Language.

Course Outcomes: After completion of the course, students will be able to:
1. Use instruction set of 8051 microcontroller to develop ALPs.
2. To write and execute simple programs using 8051 microcontroller.
3. Demonstrate the functioning of different instructions and subroutines using 8051 programming.
4. Create small application models by interfacing devices to 8051 programming through Keil/ Ride software.
5. Apply the knowledge of experiments done in the laboratory for doing mini projects and academic projects.

List of Experiments

PART-A

Using 8051 Microcontroller Kit:
1. Programs using Data Transfer Instructions- Block move, Exchange, Sorting, Finding Largest Element in an Array.
2. Programs using Arithmetic Instructions: Multi byte operations
3. Programs using Boolean and Logical Instruction (Bit manipulations).
4. Programs using JUMP and CALL Instructions
5. Programs to generate delay, programs using serial port and on chip timer/counter.
6. Programs using Look-up Table
7. Programs using interrupts.

PART-B

Program Development using 'c' cross compiler for 8051 Microcontroller
(Any 3 of the below mentioned experiments are to be Conducted)
1. DAC interfacing for Generation of Sinusoidal Waveform.
2. Stepper Motor control (clockwise and anticlockwise directions)
3. Interfacing of Keyboard and 7-segment Display Module
4. ADC interfacing for temperature monitoring
5. Traffic signal light controller

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18EEE09 **POWER QUALITY (Core Elective -3)**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. Understand the theoretical concepts and standards of Power Quality (PQ), and methods to calculate and analyze voltage sag in distribution systems.
2. Understand PQ issues and sources of harmonics in Industrial systems and its mitigation.
3. Understand the problems and solutions to wiring and Grounding

Course Outcomes: After completion of this course, students will be able to:
1. Illustrate the basic concepts of power quality issues and power quality monitoring, standards and measuring instruments.
2. Determine the voltage sag magnitude in radial, Non-radial and Meshed systems
3. Analyze voltage sags effect on three-phase AC-ASD, DC-ASD for industrial applications.
4. Identify the sources of harmonics and its mitigation techniques in industrial systems.
5. Discuss the protection devices for transient over voltages and solutions for Wiring and Grounding problems

UNIT-I
Power Quality problems in distribution systems: Sag, Swells, Interruptions, and Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations, flicker and its measurement. Tolerance of Equipment: CBEMA curve. Power quality monitoring, standards and measuring instruments.

UNIT-II
Voltage Sags-Characterization: Voltage Sag Magnitude, Sag Magnitude in Radial and Non-Radial Systems, Voltage sag Calculations in Meshed Systems.

UNIT-III
PQ Consideration in Industrial Power Systems: Adjustable speed drive (ASD) systems and applications, Characterization of voltage sags experienced by three-phase AC-ASD, DC-ASD systems, Effects of momentary voltage dips on the operation of induction and synchronous motors.

UNIT-IV
Harmonics: Sources of power system harmonics, Harmonic distortion, Harmonic Indices, Odd and Even Order Harmonics, Causes of Voltage and Current Harmonics, Locating Harmonic sources, Effect of Harmonics on Power System Devices, Mitigation of harmonics.

UNIT-V
Transient Over-voltages & Wiring and Grounding: Sources of Transient Overvoltage's, Principles of Overvoltage Protection Devices, Definitions, Reasons for Grounding and wiring, Typical Wiring and Grounding Problems, Solutions to Wiring and Grounding Problems.

Text Books:

1. C.Sankaran, 'Power Quality', CRC Press, 2001.
2. R. Sastry Vedam, M. Sarma, "Power Quality- Var Compensation in Power Systems ", CRC Press, 2009.

Suggested Reading:

1. Math H.J. Bollen, 'Understanding Power Quality Problems', IEEE Press, 2000.
2. Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H. Wayne Beaty, 'Electrical Power Systems Quality', 3rd Edition, Tata McGraw-Hill, 2012

18EEE10 ADVANCED POWER CONVERTERS (Core Elective -3)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To study various modern power electronic devices and different power factor improvement techniques in converters.
2. To study the concepts of Multi pulse and Multilevel power electronic circuits.
3. To understand different applications of power converters.

Course Outcomes: After completion of the course, students will be able to:
1. Outline various features and electrical specifications for a chosen modern power electronic device.
2. Understand different power factor improvement techniques in converters.
3. Comprehend the operation of Multi-Pulse converters and design its performance parameters.
4. Apply the concepts of different Multilevel Inverters that suits for industrial applications.
5. Recognize the applications of power converters.

UNIT-I
Modern Power Semiconductor Devices: Gate Turn Off- SCR(GTO-SCR), MOS Turn off Thyristor(MTO), Emitter Turn Off Thyristor (ETO), Integrated Gate Commutated Thyristor(IGCTs), MOS-controlled Thyristors(MCTs), symbol, structure and equivalent circuit, comparison of their features.

UNIT-II
Power factor Improvement Techniques: Power factor improvements – extinction angle control- symmetrical angle control- PWM control- SPWM control.

UNIT-III
Multi-Pulse converters: Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6-pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation

UNIT-IV
Multilevel Inverters: Multilevel concept, Classification of multilevel inverters, Diode clamped Multilevel inverter, principle of operation, main features, improved diode Clamped inverter, principle of operation, flying capacitors multilevel inverter, principle of operation, main features, cascaded multilevel inverter, principle of operation, main features, Multilevel inverter applications.

UNIT-V
Applications of Power converters: AC power supplies, classification, switched mode AC power supplies, online and offline Uninterruptible Power supplies applications. DC circuit breakers

Text Books:
1. Mohammed H. Rashid, “Power Electronics, Devices, circuits and applications”, Pearson Education, 4th Edition, 2017.
2. Ned Mohan Tore M. Undeland, “Power Electronics: Converters, Applications and Design”, John Wiley & Sons, 3rd Edition, 2007.

Suggested Reading:
1. H. W. Whittington, B. W. Flynn and D. E. MacPherson, “Switched Mode Power Supplies, Design and Construction”, Universities Press, 2009 Edition.
2. Umanand L., Bhat S.R., “Design of Magnetic Components for Switched Mode Power Converters”, Wiley Eastern Ltd., 1992
3. Robert. W. Erickson, D. Maksimovic, “Fundamentals of Power Electronics”, Springer International Edition,2013

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18EEE11 **ELECTRICAL DISTRIBUTION SYSTEMS (Core Elective -3)**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To study the load characteristics of distribution systems and understand the substation schemes, voltage drop calculation of different service areas.
2. To know about primary and secondary distribution systems and their characteristics.
3. To study different voltage control methods and applications of capacitors in distribution systems

Course Outcomes: After completion of this course, students will be able to:

1. Solve the problems on load factor, loss factor, coincidence factor and discuss the characteristics of loads along with load growth
2. Illustrate the substation bus schemes and determine the rating, voltage drop of substations
3. Determine the voltage drop and power losses of primary and secondary distribution systems
4. Analyze the distribution costs and voltage control methods in the distribution system
5. Calculate the reactive power requirements of the distribution system and summarize the functions and communications used in distribution systems

UNIT-I:

Load Characteristics: Demand, demand curve, load duration curve, Diversified demand, Non-coincident Demand, Coincidence factor, Contribution factor problems, Relationship between load and loss factors load growth, Rate structure, Customer billing, Classification of loads (residential, commercial, agricultural, and industrial) and their characteristics.

UNIT-II

Sub-Transmission Lines and Substations: Types of sub-transmission lines, Distribution substations, Substation bus schemes, Rating of distribution substation, Service area with multiple feeders, Percent voltage drop calculations.

UNIT-III

Primary and Secondary Feeders: Types of primary systems, Radial type, Loop type and Primary network, Primary feeder loading, Radial feeder with uniformly distributed load, Secondary voltage levels, Secondary banking, Secondary networks.

UNIT-IV

Voltage Drop and Power Loss Calculations: Voltage drop and power loss calculations, 3-phase, Non 3-phase primary lines, Single phase two-wire laterals with ungrounded neutral, Single phase two wire ungrounded laterals, two phase plus neutral lateral, Method to analyze distribution costs, Voltage control methods, Feeder voltage regulators.

UNIT-V

Application of Capacitors to Distribution Systems: Effects of series and shunt capacitors, Power factor correction, Economic justification for capacitors, Location and sizing of capacitors in distribution system.
Distribution System Automation: Definitions, control functions, Level of penetration of DA, Types of communication systems, Supervisory control and data acquisition.

Text Books:

1. Turan Gonen, Electric Power Distribution Engineering, TMH, 3rd Edition, 2016.
2. A.S.Pabla, Electric Power Distribution, TMH, 6th Edition, 2012.

Suggested Reading:

1. M. K. Khed Kar, G.M. Dhole, Electric Power Distribution automation, Laxmi Publications, 2010.
2. William Kersting, Distribution System Modelling and Analysis, 3rd Edition CRC Press, 2015.
3. S. Sivanagaraju, and V. Sankar, Electric Power Distribution and Automation, Dhanpat Rai & Co, 2012

18EEE12 **HVDC TRANSMISSION (Core Elective -3)**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To study the basics of HVDC and comparison between HVDC and HVAC and multi-terminal DC systems and their control methods.
2. To comprehend different converter circuits used in HVDC.
3. To familiarize with the control methods and protection methods of HVDC and its filter design techniques.

Course Outcomes: After completion of this course, students will be able to:
1. Understand the basics of HVDC and compare between HVDC and HVAC.
2. Analyze the converter circuits used in HVDC.
3. Understand the HVDC control methods and able to draw the control characteristics.
4. Understand the HVDC filter design technique and protection methods.
5. List out different MTDC links and their control.

UNIT-I
General consideration of DC and AC transmission systems: Comparison of AC and DC transmission systems, Application of DC transmission, Economic Consideration, Kinds of DC links, planning for HVDC transmission, Modem trends in DC transmission, Corona loss in AC & DC systems.

UNIT-II
Converter Circuits: Properties of Converter circuits, Different kinds of arrangements, Analysis of Bridge converters with grid control, with and without overlap angle, Equivalent circuit of rectifier. Inversion: Operation as Inverter, Equivalent circuit of Inverter.

UNIT-III
Control: Basic means of control, Limitations of manual control, Desired features of control, Combined characteristics of rectifier and inverter, Power reversal, constant minimum angle, Ignition angle control, Constant current control, Constant Extinction angle control.

UNIT-IV
Protection: Short circuit current, Arc-back, Commutation failure, Bypass valves, DC reactors, DC circuit breakers, Protection against over voltages, Harmonic filters.

UNIT-V Multi-terminal DC Systems: Application of MTDC systems, Types of MTDC systems, Comparison of series and parallel MTDC systems, Control of MTDC system (Basics).

Text Books:

1. Padiyar KR., "HVDC Power Transmission Systems", New age, 2017
2. S.Kamakshaiah and V.Kamaraju., "HVDC transmission", McGraw Hill 2017.

Suggested Reading:

1. Kimbark E.W., "Direct Current Transmission" Vol-I, JohnWtley, 1971. 1990.
2. Arrillaga J., "High Voltage Direct Current Transmission", Peter Peregrinus Ltd., London, Pergamon Press, 1983

18EEE13 AI TECHNIQUES IN ELECTRICAL ENGINEERING (Core Elective -4)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To locate soft computing methodologies, such as artificial neural networks and Fuzzy logic algorithms
2. To expose students to the basic ideas, challenges, techniques and learning algorithms in ANN and fuzzy logic techniques
3. To know the applications of AI Techniques in electrical engineering and to analyse the metaheuristic techniques in real-world problems.

Course Outcomes: After the completion of this course, students will be able to:

1. Understand the concepts of ANNs, Fuzzy logic and metaheuristic Techniques
2. Identify and describe Artificial Neural Network and Fuzzy Logic techniques in building intelligent machines
3. Apply Artificial Neural Network & Fuzzy Logic models to handle uncertainty and solve engineering problems
4. Understand how metaheuristics can be used to find good enough solutions for computationally hard optimization problems
5. Apply metaheuristic techniques to the optimization problems related to electrical Engineering
6. Develop fuzzy logic control and metaheuristic technique for applications in electrical engineering

UNIT – I

Artificial Neural Networks: Introduction, Models of Neural Network, Architectures, Knowledge representation, Artificial Intelligence and Neural networks, Learning process, Error correction learning, Hebbian learning, learning tasks.

UNIT II

ANN Paradigms: Multilayer perception using Back Propagation Algorithm, Self organizing Map, Radial Basis Function Network, Functional link network, Hopfield Network, speed control of DC and AC motors using Neural Network.

UNIT- III

Fuzzy Logic: Introduction, Fuzzy versus crisp, Fuzzy sets, Membership function, Basic Fuzzy set operations, Properties of Fuzzy sets, Fuzzy Cartesian Product, Operations on Fuzzy relations, Fuzzy Quantifiers, Fuzzy Inference, Fuzzy Rule based system, De-fuzzification methods, Speed control of DC and AC motors using Fuzzy logic controller.

UNIT-IV

Metaheuristic Techniques-1: Introduction, Particle Swarm Optimization (PSO), Ant Colony Optimization (ACO), Harmony Search (HS) algorithms, Implementation of algorithms with test functions for optimization, Economic load dispatch using PSO, ACO, HS algorithms

UNIT- V

Metaheuristic Techniques-2: Teaching Learning Based Optimization Algorithm, differential evolution algorithm, Artificial bee colony algorithm, Implementation of algorithms with test functions for optimization, Single area system and two area system, Reactive power control

Text Books:

1. S. Rajasekaran and G.A.V. Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms"- PHI, New Delhi, 2010.
2. Xin-She Yang, "Engineering Optimization: An Introduction with Metaheuristic Applications"- Wiley publication, 2010.

Suggested Reading:

1. P.D. Wasserman, VanNostrandReinhold," Neural Computing Theory & Practice"- New York,1989.
2. Bart Kosko," Neural Network & Fuzzy System" Prentice Hall, 1992.
3. Yagna Narayana, " Artificial Nueral Networks" -PHI, New Delhi,2012

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18EEE14 ELECTRIC AND HYBRID VEHICLES (Core Elective -4)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. To Know the Electric and Hybrid vehicles, and their advantages and disadvantages
2. To Understand the concept hybrid electric vehicles and energy management
3. To Develop and Optimize the design of propulsion motors for EV applications

Course Outcomes: After the completion of this course, students will be able to:

1. Be familiar to the models of describing hybrid vehicles and their performance.
2. Model the electric vehicles with different acceleration and range
3. Design Electric power train for Electric Vehicles
4. Analyze the different possible ways of energy storage
5. Illustrate the principle of Hybrid Electric Vehicle and Battery Electric Vehicle

UNIT-I

Introduction: Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, Air pollution and global warming, EV System – EV Advantages – Vehicle Mechanics – Performance of EVs, Introduction to Battery Electric Vehicle (BEV), Components and systems of Electric Vehicle, Policies and guidelines for electric mobility, Trends and challenges of implementation of mobility and start up opportunities.

UNIT-II

Hybrid Electric Vehicles: Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Electric Vehicle Modelling– Consideration of Rolling Resistance – Transmission Efficiency – Consideration of Vehicle Mass – Tractive Effort – Vehicle Acceleration – Modelling Electric Vehicle Range, Sizing of drive system, Plug-in electric vehicles, Hybrid electric drive for ship propulsion and military application,

UNIT-III

Electric Power Trains: Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybriddrive train topologies, different modes of operation, Power flow control in hybrid drive-train topologies, fuel efficiency analysis, Basic concept of electric traction, Components and systems of HEV, Selection and Sizingof the propulsion motor, Regenerative braking fundamentals, drive system efficiency

UNIT-IV

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage**,** High Energy (Nickel, Sodium and Lithium based) batteries, Metal Air batteries, battery sizing, Fuel Cell based energy storage system, Super Capacitor based energy storage and its analysis, Hybridization of different energy storage devices, Introduction to energy management strategies used in hybrid and electric vehicles.

UNIT-V

Design, Analysis, Testing & Qualification of Propulsion Motor: PM Materials, Basic concepts of Design and analysis of water cooled PM Motor for EV and HEV, Outer rotor PM Motor drive, Basic Design Aspects of Induction for EV and HEV, Testing methods and standards, Different types of EV charging stations, Wireless charging technology, Vehicle to grid (V2G) fundamentals, EMI & EMC mitigation

Text Books:

1. C. Mi, M. A. Masrur, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
3. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.

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Suggested Reading:

1. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003
2. T. Denton, “Electric and Hybrid Vehicles”, Routledge, 2016
3. Hybrid Vehicles and the future of personal transportation, Allen Fuhs, CRC Press, 2011.
4. Vehicle Power Management: Modeling, Control and Optimization, Xi Zhang, Chris Mi, Springer, 2011.
5. National Electric Mobility Mission Plan 2020 Released by DHI, Govt. of India
6. Zero Emission Vehicles (ZEV) Towards a Policy Framework, NITI Aayog
7. IEC and different IS and Eclectic Mobility Standards.

Time is what we need most, but what we use worst; Most of the misfortunes in our life are due to misused time.

Vikasa Mantras- Vivekananda Institute of Human Excellence

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18EEE15 FLEXIBLE AC TRANSMISSION SYSTEMS (Core Elective -4)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To understand concepts of various FACTS devices and controllers
2. To study the various converter topologies used in FACTS
3. To study the principles of operation and control of shunt series and combined FACTS controllers

Course Outcomes: After completion of this course, students will be able to:
1. Choose the appropriate FACTS device/controller based on the needs of inter connected power transmission systems.
2. Analyze various converter circuits used in FACTS for harmonic reduction.
3. Illustrate the operation of shunt compensators (i.e. SVC, STATCOM) for the end of line voltage support and transient stability problems
4. Analyze the operation and control of GCSC, TCSC and SSSC.
5. Explain the principles, operation and control aspects of UPFC for P and Q control

UNIT-I

General System Considerations and FACTS: Transmission Interconnections, Flow of Power in an AC System, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, principles of series and shunt compensation, Basic Types of FACTS Controllers, Benefits from FACTS, Application of FACTS.

UNIT-II

Voltage-Source Converters: Review of Voltage-Sourced Converters basics, single-Phase Full-wave Bridge converter operation, single phase-leg operation, Square-Wave Voltage Harmonics for a single-phase bridge, Three-phase full-wave bride converter, sequence of valve conduction process in each phase-leg, three-level voltage-sourced converter, Pulse-Width Modulation (PWM) converter, Generalized Technique of Harmonic Elimination and voltage control.

UNIT-III

Shunt Compensators: Objectives of Shunt Compensation, Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, improvement of Transient Stability, Power Oscillation Damping, Static Var Compensators, SVC and STATCOM, The Regulation Slope, Transfer Function and dynamic Performance, Transient Stability Enhancement and Power Oscillation Damping

UNIT-IV

Series Compensators: Objectives of Series Compensation, concept of series capacitive compensation, voltage stability, improvement of transient stability, power oscillation damping, GTO thyristor controlled series capacitor, Thyristor controlled series capacitor, SSSC.

UNIT-V

Combined Compensators: Introduction, Unified Power Flow Controller (UPFC), basic operating principles, independent real and reactive power flow control, control structure, basic control system for P and Q control.

Text Books:

1. Narain G. Hingorani, Laszlo Gyugyi, ‘Understanding FACTS’, IEEE press, 1999.
2. Y.H.Song, A.T.Johns, ‘Flexible A.C.Transmission System’, IEE, London, 1999

Suggested Reading:

1. KR Padiyar, ‘Facts Controllers In Power Transmission and Distribution’, 2nd edition, New Age Publications, 2016.
2. R. Mohan Mathur, Rajiv K. Varma, ‘Thyristor-Based FACTS Controllers for Electrical Transmission Systems’, Wiley Publications IEEE Press, 2002
3. Timothy J.E. Miller, ‘Reactive Power Control in Electric Systems’, 1982

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18EEE16 SPECIAL ELECTRICAL MACHINES (Core Elective -4)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To study the operating principles different special machines
2. To make the learner to be aware of latest special machines which are in vogue.
3. To be familiar with salient features of special electrical machines

Course Outcomes: After the completion of this course, students will be able to:
1. Recognize application specific special electrical machines
2. Explain the working principle of various special electrical machines.
3. Develop equivalent circuit of a given special electrical machine.
4. Classify the special electrical machine based on construction
5. Choose the type of armature winding suitable for a given SEM.
6. Analyse the various control methods of a given Special Electric machine.

UNIT-I

Stepper Motors: Introduction, classification, single phase, Disc Magnet and Claw-tooth stepper motors, inference from Torque equation, (no derivation) static and dynamic characteristics, open loop and closed loop control, concepts of Microprocessor based control, comparison of conventional stepper motors with permanent magnet stepper motor, VR Stepper motor and Hybrid stepper motor and applications

UNIT-II

Switched Reluctance Motor (SRM):
Construction, Principle of working, constraints on pole arc and tooth arc, Inference from torque equation and Characteristics, Control of SRM, features of Microprocessor based control of SRM, Introduction to Synchronous Reluctance Motor (Sy R M)

UNIT-III

PMDC and BLDC motor: PMDC Motor: Construction, Principle of working Minor hysteresis loops and recoil line, Equivalent circuit of PM, Inference from Torque equation, performance Characteristics, moving coil motors Printed Circuit Motor

BLDC Motor: Construction, principle of working, types, and control types and differences among various controls such as Microprocessor based, DSP- based control and sensor less control,

UNIT-IV

Linear Electric Machines: Construction, equivalent circuit, characteristics, design aspects and control, Types such as – linear synchronous motor, DC Linear motor, Linear Reluctance motor and Linear Levitation Machines (elementary treatment only)

UNIT-V

Permanent Magnet Axial Flux (PMAF) Machines: Construction, Armature windings – Toroidal stator, Trapezoidal stator, Rhomboidal Stator winding, salient features of torque equation, EMF equations and Output equation [No derivations], Phasor diagram, Applications; **Introduction to Permanent Magnet Synchronous Motor,**

Textbooks:
1. E.G. Janardhan, "Special Electrical Machines", Prentice Hall India, 2014.
2. K. Venkatarathnam, "Special Electrical Machines", Universities Press (India) Pvt. Ltd., 2013

Suggested Reading:
1. H. Bülent Ertan, M. Yildirim Üçtug, Ron Colyer, Alfio Consoli, "Modern Electrical Drives" Springer Science+Bussiness Media, 2000

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Department of Electrical and Electronics Engineering

Chaitanya Bharathi Institute of Technology (A)

Gandipet, Hyderabad-500075.

VISION and MISSION of the Institute

Vision

To be a centre of excellence in technical education and research

Mission

To address the emerging needs through quality technical education and advanced research

Quality Policy

Chaitanya Bharathi Institute of Technology imparts value based technical education and training to meet the requirements of student, industry, trade/ profession, research and development organisations for self-sustained growth of society.

VISION and MISSION of the Department

Vision

To be in forefront in assimilating cutting edge technologies in the field of Power & Electronics arena

Mission

To solve practical problems through industry institute interaction for implementation and to encourage taking up multidisciplinary research while maintaining ethics and morals for the sustainable development of the society.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
SCHEME OF INSTRUCTION AND EXAMINATION
VII-Semester of B.E/B.Tech under CBCS
B.E.(EEE)

SEMESTER-VII

S. No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L/T	P/D	Scheme of Examination: Duration in Hours	Maximum Marks CIE	SEE	Credits
THEORY								
1.	**16EE C31**	Power System Operation and Control	4	-	3	30	70	4
2.	**16EE C32**	Utilization of Electrical Energy	3	-	3	30	70	3
3.	**16EE C33**	DSP and Embedded Systems	4	-	3	30	70	4
4.	**16EE EXX**	Program Specific Elective- 4	3	-	3	30	70	3
5.	**16XX OYY**	Open Elective-I	3	-	3	30	70	3
PRACTICALS								
6.	**16EE C34**	Power Systems Simulation Lab	0/1	2	3	25	50	2
7.	**16EE C35**	Digital Signal Processor and Embedded Systems Lab`	0/1	2	3	25	50	2
8.	**16EE C36**	Project Seminar	0	3	-	50	-	2
			19	**07**	**-**	**250**	**450**	**23**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-4
16EEE14	Basic VLSI Design
16EEE15	Computer Methods in Power Systems(CMPS)
16EEE16	Power Quality Engineering(PQE)
16EEE17	Special Electrical Machines(SEM)

Course Code	Open Elective-I
16PY O01	History of Science and Technology
16EG O02	Gender Sensitization
16CE O02	Disaster Mitigation and Management (DMM)
16CS O10	Machine Learning Using Phyton
16ME O01	Entrepreneurship

16EE C31

POWER SYSTEM OPERATION AND CONTROL

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the formulation of Load-Flow problems applying different methods and economic operation of power systems
2. To understand the importance of Load Frequency Control and stability of power systems.
3. To study the reactive power control and basic FACTS controllers

Course Outcomes: After completion of this course, students will be able to:

1. Acquire knowledge in assessing the importance of load flow studies in power system operation. Carryout Load-Flow studies with different methods compare and interpret the results.
2. Acquire knowledge in conducting Economic operation of power system without and with losses
3. Acquire knowledge in conducting Load Frequency Control for single and two area systems and also distinguish between different control methods.
4. Acquire knowledge in analyzing the Stability aspects of power system.
5. Acquire knowledge in assessing the system improvement through reactive power control and FACTS controllers.

UNIT-I

Load Flow Studies: Formulation of Y bus for a system, modeling of tap changing and phase shifting transformer, Formulation of load flow problem, Solution of load flow by Gauss Seidel, Newton- Raphson, Decoupled and Fast Decoupled methods, comparison of different load flow methods.

UNIT-II

Economic Operation of Power System: Input-Output curves, Heat rates and incremental cost curves, Equal Incremental cost criterion Neglecting transmission losses with and without generator limits, B_{mn} Coefficients, Economic operation including transmission losses.

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UNIT-III

Load Frequency Control: Governor Characteristics, Regulation of two generators, coherency, concept of control area, Incremental power balance of a control area, Single area control, Flat frequency control, Flat tie-line frequency control, Tie-line bias control, Advantages of pool operation, Development of model for two- area control.

UNIT-IV

Power System Stability: Definitions Steady state stability and Transient stability, Steady state stability of a synchronous machine connected to infinite bus, calculation of steady state stability limit, synchronous machine models with and without saliency, Equal area criterion, Application of equal area criterion, Swing equation, Step by step solution of Swing equation, factors effecting transient stability, Auto Reclosures, mathematical formulation of voltage stability problem.

UNIT-V

Reactive Power Control: Reactive power generation by synchronous generators, Automatic voltage regulators, FACTS Controllers, SVC, TCSC, STATCOM, UPFC.

Text Books:

1. I. J. Nagrath and D.P. Kothari, Modern Power System Analysis, TMH Publication, 4th Edition 2011
2. C.L.Wadhwa, Electrical Power System, New Age International Publications, 3rd Edition, 2014
3. O. Elgard, Electric Energy Systems Theory, TMH Publication, 2nd Edition, 2001.

Suggested Reading:

1. A. Chakrabarthy and S. Halder, Power System Analysis Operation & control, PHI Publications, 3rd Edition, 2010
2. J.J.Grainger and William D Stevenson, Power System Analysis, Mc Graw Hill Publishers, 2016
3. S. Sivanagaraju, and G. Srinivas, 'Power system, Operation and Control', Pearson publications, 2010.

16EE C32

UTILIZATION OF ELECTRICAL ENERGY

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Understand the adaptability of heating and welding concepts for a given application
2. Know the necessity of illumination and batteries for specified requirement
3. Know selection of proper traction system and its corresponding drive for industrial applications

Course outcomes: After completion of this course, Students will able to:

1. Select the proper furnace system for a given requirement
2. Distinguish the adaptability of heating and welding concepts for a given application
3. Identify the necessity of illumination for specified requirement
4. Select proper traction system and its corresponding drive for industrial applications
5. Able to estimate energy consumption levels at various modes of operation.

UNIT-I

Electric Heating: Introduction, Classification of electric heating, Electric Resistance Heating, Resistance Ovens, Properties of good heating material, Different types of heating material, Causes of failure of heating element, Design of heating element- Numerical Problems.

Arc Furnaces: Direct Arc Furnace, Indirect Arc Furnace, Induction Heating, Direct Core-type Induction Furnace, Vertical Core-Type Induction Furnace, Indirect Core-Type Induction Furnace, Coreless Induction Furnace, High Frequency Eddy-current Heating, Dielectric Heating- Numerical Problems.

UNIT-II

Electric Welding: Introduction, Classification of Welding Processes, Formation and Characteristics of Electric Arc, Effect of Arc Length, Electrodes for Metal Arc Welding, Advantages of Coated Electrodes, Types of Joints - Welding Transformer.

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Electric Arc welding: Carbon Arc Welding, Submerged Arc Welding, Atomic Hydrogen Welding.
Resistance Welding: Spot Welding, Seam Welding, Projection Welding, Butt Welding, Flash Butt Welding, Upset Welding, Electron Beam Welding, Laser Welding - Numerical Problems

UNIT-III
Illumination: Introduction, Terms used in illumination, laws of illumination, Polar Curves of C.P. Distribution – Determination of M.S.C.P. and M.H.C.P. from Polar Diagrams- Rousseau's construction, Lighting Schemes- Design of Lighting Schemes- Application to factory lighting, Street lighting and Flood lighting - Numerical Problems

Electric Lamps: Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems - Numerical Problems

UNIT-IV
Electric Traction-I: Introduction, Systems of electric traction and track electrification- DC system, single phase and 3-phase low frequency and high frequency system, composite system, kando system, comparison between AC and DC systems- Train Movement-Typical Speed/Time Curve - Factors affecting scheduled speed - Simplified Speed/Time Curve - Average and Schedule Speed - Tractive Effort for Propulsion of a Train - Power Output from Driving Axles - Energy Output from Driving Axles - Numerical Problems.

UNIT-V
Electric Traction-II: Specific Energy Output - Evaluation of Specific Energy Output - Energy Consumption - Specific Energy Consumption - Adhesive Weight - Coefficient of Adhesion - Mechanism of Train Movement - Numerical Problems

Text Books:

1. C L Wadhwa, Generation, Distribution and Utilization of Electrical Energy- 3 rd Edition New age international publishers, 2015.
2. B.L. Theraja, A Textbook of Electrical Technology Volume-III Transmission and Distribution S. Chand Limited, 23rd Edition, 2013.
3. Partab H, Art and Science of Utilization of Electric power, Dhanpatrai & Sons, 2014

Suggested Reading:

1. J.B.GUPTA, Utilization of Electric Power and Electric Traction- S.K.Kataria & Sons, 2013.
2. R K. Rajput, Utilization of Electrical Power-, 2 nd Edition, Laxmi Publications (p) Ltd, 2016.

16EE C33

DSP & EMBEDDED SYSTEMS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:
1. To introduce basic concepts of signals and systems and representation of digital system.
2. To introduce digital signal processor
3. To introduce fundamentals of Real time operation and ARM processor

Course Outcomes: After completion of this course, students will be able to:
1. Identify the digital system and find its response.
2. Design FIR and IIR filter.
3. Be familiar with architecture and features of TMS 320F/2047 DSP.
4. Understand the basic concepts of real time operating systems
5. Be familiar with architecture and features of ARM processor.

UNIT-I
Introduction to signals and systems: Classification of Signals & Systems, Linear shift invariant systems, stability and causality, Sampling of Continuous signals, Signal Reconstruction, quantizing & encoding, linear constant co-efficient difference equations, properties of discrete system- linearity. Analog to digital conversion - Nyquist criteria

UNIT-II
Fourier transforms and filters: Magnitude and phase response discrete time systems - Computation of DFT and IDFT -Properties of Discrete Fourier Transform, - Linear and circular Convolution of sequence using DFT. Fast Fourier transform: Radix-2 decimation in time and decimation in frequency FFT algorithms, Inverse FFT. Introduction to IIR Low pass butter worth & Chebyshev digital filters using impulse invariant and bilinear transformation techniques, FIR Rectangular and Kaiserwindows

UNIT-III
DSP Processors: Differences between DSP and other mp architectures,. Basic architectural features, DSP computational building blocks, Bus and Memory

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architecture, Address generation unit, speed issues, fixed point DSPs - Architecture of TMS 320C 54X Processor , addressing modes, on-chip peripherals, Real Time operating constraints

UNIT-IV

Real-Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, Shared Data, Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment. Semaphores and Queues, Hard Real-TimeScheduling Considerations, Host and Target machines, Linker/Locators for Embedded Software.

UNIT-V

Advanced architectures: ARM Processor, memory organization and Instruction level parallelism, Net advanced embedded systems: Bus protocols, 12C bus and CAN bus, Internet- Enabled Systems

Text Books:

1. Avatar Singh and S. Srinivasan, " Digital Signal Processing Implementations Using DSP Microprocessors", Thomson Brooks, 2004.
2. Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Morgan Kaufmann Publisher, 2006.

Suggested Reading:

1. B. Ventakaramani, M. Bhaskar, "Digital Signal Processes, Architecture Processing and Applications", Tata McGraw Hill, 2002.
2. David E-Simon, "An Embedded Software Primer", Pearson Education, 2007.
3. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dreamtech press, 2005.

16EE C34

POWER SYSTMES SIMULATION LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To understand the load flows, transient stability studies, economic load dispatch and load frequency control in power system
2. To understand the time and frequency response of the system
3. To Simulate and compare the output of converters with different loads

Course Outcomes: After completion of this course, students will be able to:

1. Acquire knowledge about Load frequency control
2. Analyse Load flow studies and economic load dispatch
3. Acquire knowledge about transient stability studies
4. Analyse semi, full and buck & boost converters
5. Acquire knowledge about time and frequency response of the system

List of Experiments:

1. Determination of power angle diagram for Salient and Non-salient pole synchronous machine.
2. Frequency response characteristics using Bode plot
3. Root Locus & Nyquist method
4. Design of lag, lead and lag-lead compensator
5. Computation of line parameters
6. Modeling of Transmission Lines
7. Load Flow Studies.
8. Fault Analysis.
9. Transient stability studies.
10. Economic load dispatch.
11. Load Frequency control of single-area and two-area systems
12. Single-phase semi-converter with R and RL loads
13. Single-phase full-converter with R and RL loads
14. Analysis of Buck and Buck-Boost converter

Note: At least **TEN** experiments should be conducted in the Semester

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16EE C35

DIGITALSIGNALPROCESSING & EMBEDDED SYSTEMS LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To learn to analyze and synthesize signal using DSP
2. To acquire knowledge on digital control of electrical appliances
3. To practice programming using embedded processor and to learn to interface various electrical equipments to embedded controller

Course Outcomes: After completion of this course, students will be able to:

1. Control AC machines using DSP
2. Control DC machines using DSP
3. To simulate control signals using MATLAB
4. To generate the output sequence using micro controller.
5. Control the operation of different equipments to embedded controller

List of Experiments:

1. Verification of Convolution Theorem Using MATLAB.
2. Computation of DFT, IDFT using Direct and FFT methods.
3. Verification of Sampling Theorem
4. Design of Butterworth and Chebyshev LP & HP filters.
5. DC Motor speed control using DSP.
6. Three phase IM speed control using DSP
7. Simulation of switching sequence for relay operations.
8. Simulation of switching sequence with time delay.
9. Simulation of relay operations using different ports.
10. Interfacing 7 segment display using SPI through microcontroller.
11. Interfacing ADC through microcontroller.
12. Interfacing DAC through microcontroller.
13. Interfacing stepper Motors through microcontroller.

Note: Any **Ten** experiments from should be conducted from the above list in the semester.

16EE C36

PROJECT SEMINAR

Instruction	3 Hours per week
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/ Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks:

Max. Marks: 50

Evaluation by	Max . Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

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16EE E14

Program Specific Elective-4

BASIC VLSI DESIGN

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the MOSFET structures and operations
2. To learn to design logic circuits using pMOS and nMOS
3. To learn to design concepts of CMOs and HDL Programing.

Course Outcomes: After completion of this course, students will be able to:

1. To design logic circuits using pMOS and nMOS technologies
2. To design cMOS logic circuits.
3. To simulate logical circuits using HDL programming
4. To understand different modeling strategies
5. To understand FPGA design strategies.

UNIT-I

MOS CIRCUIT DESIGN PROCESS: Introduction of MOSFET: Symbols, Enhancement mode-Depletion mode transistor operation – Threshold voltage derivation – body effect – Drain current Vs voltage derivation – channel length modulation. nMOS and pMOS inverter – Determination of pull up to pull down ratio –Stick diagrams – VLSI Circuit Design Flow.

UNIT-II

MOS TECHNOLOGY: Chip Design Hierarchy – IC Layers – Photolithography and Pattern Transfers – Basic MOS Transistors – CMOS Fabrication: n-well – p-well – twin tub – Latch up and prevention (SOI) – Submicron CMOS Process-Masks and Layout - CMOS Design Rules: Lambda based layout.

UNIT-III

LOGIC DESIGN USING nMOS and cMOS: Gate delays – Logical Effort - CMOS Static Logic – Transmission Gate Logic – Tri-State Logic – Pass Transistor Logic – Dynamic CMOS Logic –Realization of logic gates – using nMOS and CMOS technologies– Stick diagrams of logic gates-Simple full adder – four input Encoder- Decoder.

UNIT-IV

VERILOG HDL: Hierarchical modeling concepts – Basic concepts: Lexical conventions – Data types – Modules and ports. Gate level modeling – Dataflow modeling – Behavioral modeling – Design examples of Combinational and Sequential circuits – Switch level modeling.

UNIT-V

VLSI IMPLEMENTATION STRATEGIES: Introduction – Design of Adders: carry look ahead-carry select-carry save. Design of multipliers Introduction to FPGA – Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures.

Text Books:

1. Douglas A.Pucknell & Kamran Eshraghian," Basic VLSI Design", 3rd edition, Prentice Hall India, 2001.
2. Wayne Wolf, "Modern VLSI Design: System -on-chip design", Pearson Education, 3rd edition, 2002.

Suggested Reading:

1. David A. Johns & Ken Martin, "Analog Integrated Circuit Design", John Wiley & Sons, 2004.
2. Neil. H.E. Weste & Kamran Eshraghian," principles of CMOS VLSI Design: A systems perspective", 2nd edition, Pearson Education, 2004.

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16EE E15

COMPUTER METHODS IN POWER SYSTEMS

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To study the formulation of various incidence matrices and network matrices such as YBUS, YBR and Zloop
2. To know about the formation of ZBUS for given power system network.
3. To understand the calculation of fault currents using ZBUS in three phase power system network.

Course Outcomes: After completion of this course, students will be able to:

1. Draw the graph and find the network metrics for the given power system network.
2. Modify the Zbus for changes in the network structure.
3. Determine the fault currents in three-phase power system for different faults
4. Acquire the knowledge of different transformation techniques
5. Find the ZBUS for given three-phase network.

UNIT-I

Graph Theory: Definitions, Incidence Matrices, Element node incidence matrix, Bus incidence matrix, Branch path incidence matrix, Basic and Augmented cut set incidence matrices, Basic and Augmented branch incidence matrices, Basic and Augmented loop incidence matrices, Construction of Primitive network element.

UNIT-II

Formulation of Network Matrices: Formation of Ybus, YBR and Zloop by Singular Transformation Method, Derivation of YBR, Yloop, Zbus and Ybus from non-singular transformation method.

UNIT-III

Formation of ZBus: Partial network, Algorithm for the Modification of ZBus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses, Modification of ZBus for the changes in network.

UNIT-IV

Three-phase Networks: Representation and performance equation of 3-phase network elements ,Three phase network elements with balanced and unbalanced excitation, Transformation matrices, Symmetrical and Clarke's components, Algorithm for formation of 3-phase bus impedance matrix, Modification of three phase ZBUS for changes in network

UNIT-V

Short Circuit Studies: Basic assumption in short circuit studies, System representation, General equations for short circuit study in phase variables and Symmetrical components for fault current and node voltage, Short circuit calculations for balanced three phase network using ZBUS, Fault impedance and admittance matrices, Analysis of 3-phase line to ground and double line to ground faults, Flow chart for short circuit study.

Text Books:

1. Stagg & El-Abiad, Computer methods in Power System Analysis, 9th Edition, Tata McGraw Hill, 1983.
2. M.A.Pai, Computer techniques in Power System Analysis, 3rd Edition, Tata McGraw Hill, 2014.

Suggested Reading:

1. L.P.Singh, Advanced Power System Analysis & Dynamics, 6th Edition, New Age International Publishers, 2014.
2. Kusic Gearge L, Computer Aided Power System Analysis, 2nd Edition, CRC Press, 2008.

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16EE E16

POWER QUALITY ENGINEERING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Understand the theoretical concepts and standards of Power Quality (PQ), and methods to calculate and analyze voltage sag in distribution systems.
2. Understand PQ issues and sources of harmonics in Industrial systems and its mitigation
3. Understand the problems and solutions to wiring and Grounding

Course Outcomes: After completion of this course, students will be able to:

1. Understand the basic concepts of power quality and acquire the knowledge in measurement and standards of PQ problems
2. Acquire the knowledge to analyze voltage sag in distribution systems
3. Acquire the knowledge of theoretical concepts and standards of Power Quality issues in industrial systems.
4. Acquire the knowledge in identifying sources of harmonic & mitigation of harmonics in industrial systems.
5. Acquire the knowledge in Solutions to Wiring and Grounding Problems.

UNIT-I

Power Quality problems in distribution systems: Sag, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve. Power quality monitoring, PQ measurement equipment.

UNIT-II

Voltage Sags-Characterization: Voltage Sag Magnitude, Sag Magnitude in Radial and Non-Radial Systems, Voltage sag Calculations in Meshed Systems, Magnitude-Duration Plots.

UNIT-III

PQ Consideration in Industrial Power Systems: Adjustable speed drive (ASD) systems and applications, Characterization of voltage sags experienced by three-phase AC-ASD,DC-ASD systems, Effects of momentary voltage dips on the operation of induction and synchronous motors. PQ monitoring standards.

UNIT-IV

Harmonics: Sources of power system harmonics, Harmonic distortion, Harmonic Indices, Odd and Even Order Harmonics, Causes of Voltage and Current Harmonics, Locating Harmonic sources, Effect of Harmonics on Power System Devices, Mitigation of harmonics.

UNIT-V

Transient Over-voltages & Wiring and Grounding: Sources of Transient Overvoltage's, Principles of Overvoltage Protection Devices for Overvoltage Protection, Definitions, Reasons for Grounding, Typical Wiring and Grounding Problems, Solutions to Wiring and Grounding Problems.

Text Books:

1. C.Sankaran, 'Power Quality', CRC Press, 2001.
2. R.Sastry Vedam, M.Sarma, "Power Quality- Var Compensation in Power Systems ", CRC Press, 2009.

Suggested Reading:

1. Math H.J. Bollen, 'Understanding Power Quality Problems', IEEE Press, 2000.
2. Roger C.Dugan, Mark F.McGranaghan, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality', 3rd Edition,Tata McGraw-Hill, 2012.

16EE E17

SPECIAL ELECTRICAL MACHINES

Instruction	3 Hours per week
Duration of Semester Examination	3 Hours
Semester End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To study the operating principles different special machines
2. To make the learner to be aware of latest special machines which are in vogue.
3. To be familiar with design features of special electrical machines

Course Outcomes: After completion of this course, students will be able to:

1. Identify appropriate machine for a specific application.
2. Recognize the principle of operation and characteristics of the given special machine.
3. Familiar with driver circuit used for special machines
4. Develop equivalent circuit of a given special electrical machine
5. Distinguish the special machine with the obtained characteristics

UNIT-I

Stepper Motors and its Mathematical Analysis: Introduction, Synchronous Induction (or Hybrid) Stepper Motor, Hybrid stepping motor: Construction, Principle of operation, energisation with two phase at a time, An Open -Loop Controller for a 2-Phase Stepper Motor, Variable Reluctance (VR) Stepping Motor, Open -Loop Control of 3-Phase VR Step Motor, Voltage current relation and torque expression, Transformation of equation into d-q reference frame, Normalization of d-q axis.

UNIT-II

Switched reluctance motor : Introduction , Improvements in the design of conventional reluctance motors, Some distinctive difference between SR and conventional reluctance motor, Principle of operation of SRM, Some design aspects of stator and rotor pole arcs, Power converter for SR motor, A numerical example, Derivation of torque expression, General -Linear case.

UNIT-III

Permanent magnet materials and motors: Introduction, Minor hysteresis loops and recoil line, Stator frame (pole and yoke part) of conventional PMDC motors,

Equivalent circuit of PM, Development of electronically commutated DC motor from conventional DC motor.

UNIT-IV

BLDC motors: Types of construction, Principle of operation, Sensing and switching logic scheme, Drive and power circuits, Theoretical Analysis and Performance prediction.

UNIT-V

Linear induction motor: Development of double sided LIM from rotary type IM, A schematic of LIM drive from electric traction, Field analysis of a DSLIM, Fundamental assumption, Transverse edge (or finite width) effects in LIM, Solution for current distribution in rotor, Force calculation on rotor of finite width : estimation of resistivity factor.

Text Books:

1. K. Venkatarathnam, “Special Electrical Machines”, Universities Press(India) Pvt. Ltd., 2013
2. E.G. Janardhan, “Special Electrical Machines”, Prentice Hall India, 2014

Suggested Reading:

1 . H. Bülent Ertan, M. Yildirim Üçtug, Ron Colyer, Alfio Consoli, “Modern Electrical Dives” Springer Science+Bussiness Media, 2000

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16PY O01

Open Elective-I

History of Science and Technology

Instruction	3 Hours per week
Duration of Semester Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To enablestudents to understand science as a socio-cultural product in specific socio-historical contexts.
2. To expose students to philosophical, historical and sociological perspectives to look atscience as a practice deeply embedded in culture and society.
3. To inculcate the scientific culture and ethics in the development of technologies.

Course Outcomes:

1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rigor and sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

UNIT-I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers,Agricultural Revolution and other revolutions,Civilization,Major advances.

Science in Antiquity (600 BC - 529 AD): Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT-II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances.

The Renaissance and the Scientific Revolution (1453 AD – 1659 AD): Renaissance, Scientific Revolution, Technology, Major advances.

UNIT-III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances.

The Industrial Revolution (1735 AD – 1819 AD): Industrial Revolution, Rise of the engineer, Major Advances.

UNIT-IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science,Science and the public, Science and technology, Major advances.

Rise of Modern Science and Technology (1895 AD – 1945 AD): The growth of 20thcentury science, Newphilosophies, Quantum reality, Energy sources, Electricity: a revolution intechnology, Majoradvances.

UNIT-V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances.

The Information Age (1973 AD – 2015 AD): Information and society, Globalization, The post-industrial society,Problems of the Information age, Major Advances

Text Books:

1. Bryan Bunch and Alexander Hellemans, “The History of Science and Technology”, Houghton Mifflin Company (New York), 2004
2. JD Bernal, “Science in History”, 4 Volumes, Eklavya Publishers, 2012

Suggested Readings:

1. “The 100 Most Influential Scientists of All Time”, Edited by Kara Rogers, Britannica Educational Publishing, 2010
2. Alberto Hernandez, “A Visual History of Science and Technology”, The Rosen Publishing Group, 2016

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16EG O02

GENDER SENSITIZATION

Instruction	3 Hourss per week
Duration of SEE Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will introduce the students to

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course Outcomes: After successful completion of the course the students will be able to

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

UNIT – I

Understanding Gender:

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)

Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II

Gender And Biology:

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)

Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)

Two or Many? Struggles with Discrimination.

UNIT – III

Gender and Labour:

Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)

"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit - 7)

Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and

Conditions of Work.

UNIT - IV

Issues Of Violence

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading:

"Chupulu".

Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading:

New Forums for Justice.

Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)

Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V

Gender: Co - Existence

Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.

Additional Reading: Rosa Parks-The Brave Heart.

Textbook:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu **"Towards a World of Equals: A**

Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, **2015**.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. **"I Fought For My Life…and Won."**Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india.

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

16CE O02

DISASTER MITIGATION AND MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course Outcomes: At the end of the course the student

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. To understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various

participatory approaches/strategies and their application in disaster management

UNIT-I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II:

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III:

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT-IV:

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other

stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni*," Disaster Risk Reduction in South Asia*", Prentice Hall, 2003.
2. B. K. Singh*," Handbook of Disaster Management*: *techniques & Guidelines*", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs". *Government of India, "National disaster management plan, Part I and II",*
2. K. K. Ghosh," *Disaster Management",* APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

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16CS O10

MACHINE LEARNING USING PYTHON

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:
1. Get an idea of Machine Learning algorithms to solve real world problems.
2. Study various machine learning algorithms.
3. Analyze data using machine learning techniques.

Course Outcomes: On Successful completion of this course, student will be able to
1. Understand the basics concepts of Machine Learning and Python.
2. Apply feature engineering techniques and visualization tools to the data.
3. Analyze the various types of data by using python based machine learning techniques.
4. Identify and evaluate various recommender systems.
5. Design solutions to real world problems using deep learning algorithms.

UNIT-I

Introduction to Machine Learning: Introduction, Machine Learning process. **Introduction to Python**: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT-II

Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python. **Data Visualization:** Various charts, histograms, plots.

UNIT-III

Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression. **Classification:** Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes.

UNIT-IV

Unsupervised Learning: Clustering, K-Means clustering, Hierarchical clustering. **Text Analysis:** Basic text analysis with Python, regular expressions, NLP, text classification. **Time Series Analysis**: Date and time handling, window functions, correlation, time series forecasting.

UNIT-V

Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework. **Recommender System:** Recommendation engines, collaborative filtering.

Text Books:

1. Abhishek Vijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018
2. Tom Mitchel "Machine Learning", Tata McGraWHill, 2017
3. Reema Thareja "Python Programming", Oxford Press, 2017.

Suggested Reading:

1. Yuxi Liu, Python Machine Learning by Example, 2nd Edition, PACT, 2017

Online Resources:
1. https://www.guru99.com/machine-learning-tutorial.html
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

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16ME O01

ENTREPRENEURSHIP

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand
1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Outcomes: After completing this course, students will be able to:
1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

UNIT-I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT-II

Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT-III

Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT-IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V

Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, “Dynamics of Entrepreneurial Development and Management”, Himalaya Publishing House, 1997.
2. Prasanna Chandra, “Project-Planning, Analysis, Selection, Implementation and Review”, Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, “Entrepreneurial Development”, S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, “Entrepreneurship”, 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, “First Things First”, Simon and Schuster Publication, 1994.
3. Sudha G.S., “Organizational Behavior”, National Publishing House, 1996.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTION AND EXAMINATION
VIII-Semester of B.E/B.Tech under CBCS
B.E. (EEE)

SEMESTER-VIII

S. No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L/T	Scheme of Instruction: Hours per week P/D	Scheme of Examination: Duration in Hours	Maximum Marks CIE	Maximum Marks SEE	Credits
THEORY								
1.	16EEEXX	Program Specific Elective - 5	3	-	3	30	70	3
2.	16EEEXX	Program Specific Elective -6	3	-	3	30	70	3
3.	16XXXXX	Open Elective -II	3	-	3	30	70	3
PRACTICALS								
4.	16EE C37	Seminar	-	3	-	50	-	2
5.	16EE C38	Project	-	6	Viva voce	50	100	6
			09	09	-	190	310	17

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-5	Equivalent NPTEL Courses
16EE E18	Electrical Machine Design(EMD)	
16EE E19	Flexible AC Transmission Systems(FACTS)	FACTS Devices
16EE E20	Power System Reliability (PSR)	
16EE E21	Smart Grid(SG)	Introduction to Smart Grids

Course Code	Program Specific Elective-6	Equivalent NPTEL Courses
16EE E22	Embedded System Design (ESD)	Embedded System Design with ARM
16EE E23	Advanced Power System Protection (APSP)	
16EE E24	Power System Operation and Deregulation(PSOD)	
16EE E25	Electrical Estimation and Costing(EEC)	

Course Code	Open Elective-II	Equivalent NPTEL Courses
16EG O01	Technical Writing Skills	
16ME O04	Intellectual Property Rights (IPR)	Intellectual Property Rights
16 ME O08	Industrial Administration and Financial Management (IAFM)	
16CS O03	IOT and Applications	Introduction to IoT
16CS O04	Basics of Data Science Using R	Machine Learning

Note: Student undergoing internship is permitted to take-up Equivalent NPTEL courses with the prior permission from BoS.

16EE C37

SEMINAR

Instruction	3Hours per week
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summaryand Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

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Guidelines for awarding marks		
Sl No.	**Description**	**Max Marks**
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

16EE C38

PROJECT

Instruction	6 Hours per week
CIE	50 Marks
SEE	100 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/ Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 50)

Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

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Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project ● Innovations ● Applications ● Live Research Projects ● Scope for future study ● Application to society
	20	Viva-Voce

16EE E18

Program Specific Elective-5
ELECTRICALMACHINEDESIGN

Instruction	3 Hours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. To understand the design parameters of various electrical machines**.**

2. To analyze the electrical and mechanical characteristics of electrical machines**.**

3. To become familiar with CAD usage

Course Outcomes: After completion of this course, students will be able to:

1. Design the given AC electrical machine for a given power rating.
2. Calculate the various parameters required for designing.
3. Choose the proper material for a given requirement of the machine.
4. Use software tools for DC & AC machine design.
5. Acquire the knowledge of CAD

UNIT-I

Basics of Machine design aspects: Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT-II

Design of Transformers: Sizing of a transformer, main dimensions, KVA output for single and three-phase transformers, window space factor, overall dimensions, design of cooling tank, methods for cooling of transformers.

UNIT-III

Design of Induction Motors: Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, magnetic leakage calculations, leakage reactance of poly phase machines, magnetizing current, short circuit current,.

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UNIT-IV

Design of Synchronous Machines: Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of turbo alternators.

UNIT-V

Computer aided Design (CAD): Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design.

Text books:

1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. K. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.

Suggested Reading:

1. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.
2. K. L. Narang, "A Text Book of Electrical Engineering Drawings", SatyaPrakashan, 1969.
3. A. Shanmugasundaram, G. Gangadharan and R. Palani, "Electrical Machine Design Data Book", New Age International, 1979.

16EE E19

FACTS
(Flexible AC Transmission Systems)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand concepts of various FACTS devices and controllers
2. To study the various converter topologies used in FACTS
3. To study the principles of operation and control of shunt series and combined FACTS controllers

Course Outcomes: After completion of the course students will be able to:

1. Select the appropriate FACTS device/controller based on the needs of inter connected power transmission systems.
2. Analyze various converter topologies used in FACTS for harmonic reduction.
3. Demonstrate the knowledge of shunt compensators(i.e SVC,STATCOM) for the end of line voltage support and transient stability problems
4. Analyze the operation and control of GCSC, TCSC and SSSC.
5. Demonstrate the principles, operation and control aspects of UPFC for P and Q control

UNIT-I

General System Considerations and FACTS: Transmission Interconnections, Flow of Power in an AC System, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, principles of series and shunt compensation, Basic Types of FACTS Controllers, Benefits from FACTS, Application of FACTS.

UNIT-II

Voltage-Source Converters: Basic concept of Voltage-Sourced Converters, single-Phase Full-wave Bridge converter operation, single phase-leg operation, square-Wave Voltage Harmonics for a single-phase bridge, Three-phase full-wave bride converter, sequence of valve conduction process in each phase-leg,

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three-level voltage-sourced converter, Pulse-Width Modulation (PWM) converter, Generalized Technique of Harmonic Elimination and voltage control.

UNIT-III

Shunt Compensators: Objectives of Shunt Compensation, Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, improvement of Transient Stability, Power Oscillation Damping, Static Var Compensators, SVC and STATCOM, The Regulation Slope, Transfer Function and dynamic Performance, Transient Stability Enhancement and Power Oscillation Damping

UNIT-IV

Series Compensators: Objectives of Series Compensation, concept of series capacitive compensation, voltage stability, improvement of transient stability, power oscillation damping, GTO thyristor controlled series capacitor, Thyristor controlled series capacitor, SSSC.

UNIT-V

Combined Compensators: Introduction, Unified Power Flow Controller (UPFC), basic operating principles, independent real and reactive power flow control, control structure, basic control system for P and Q control.

Text Books:

1. Narain G. Hingorani, Laszlo Gyugyi, 'Understanding FACTS', IEEE press, 1999.
2. Y.H.Song, A.T.Johns, 'Flexible A.C.Transmission System', IEE, London, 1999

Suggested Reading:

1. KR Padiyar, 'Facts Controllers In Power Transmission and Distribution', 2nd edition, New Age Publications, 2016.
2. R. Mohan Mathur, Rajiv K. Varma, 'Thyristor-Based FACTS Controllers for Electrical Transmission Systems', Wiley Publications IEEE Press, 2002
3. Timothy J.E. Miller, 'Reactive Power Control in Electric Systems', 1982.

16EE E20

POWER SYSTEM RELIABILITY

Instruction	3Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	70Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand probability theory and distributions
2. To understand component reliability types and causes of failures reliability logic diagram for different configuration.
3. To Understand discrete Markov chains and continuous Markov process and the importance of reliability evaluation of repairable systems

Course Outcomes: After completion of the course, students will be able to:

1. Acquire knowledge and to apply probability theory and distribution functions to engineering applications.
2. Acquire knowledge to study and to classify types of causes of failures, reliability logic diagram for different configurations.
3. Acquire knowledge to study discrete and continuous Markov chains and process and give thrust to reliability evaluation of repairable systems.
4. Evaluate various generation and load models
5. Apply reliability analysis on a given generation and distribution system.

UNIT-I

Elements of probability theory -Probability distributions: Discrete and continuous random variables, density and distribution functions, Mathematical expectation-Mean and Variance, Binominal distribution, Poisson distribution, Normal .distribution, Exponential distribution, Weibull distribution.

UNIT-II

Reliability: Definition, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Causes of failures, types of failures.Bath tub curve, MTTR, MTBF. Reliability logic diagrams for series, parallel, series-parallel, non series-parallel configurations. Minimal cut-set and decomposition methods.

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UNIT-III

Markov Modeling: General modelling concepts, stochastic transitional probability matrix, time dependent probability evaluation and limiting state probability evaluation. Absorbing states. Continuous Markov Processes: Modelling concepts, State space diagrams, Stochastic Transitional Probability Matrix, Evaluating limiting state Probabilities. Reliability evaluation of repairable systems.

UNIT-IV

Generating System Reliability Analysis: Generation system model- capacity outage probability tables -Recursive relation for capacitive model building '-sequential addition method -unit removal- Evaluation of loss of load and energy indices. Evaluation of equivalent transitional rates of identical and nonidentical units -Evaluation of cumulative probability and cumulative frequency of nonidentical generating units -2'-level daily load representation - merging generation and load models

UNIT-V

Distribution System Reliability Analysis: Radial networks –Evaluation of Basic reliability indices, performance indices -load point and system reliability indices - customer oriented, loss and energy oriented indices. Parallel networks- inclusion of bus bar failures, scheduled maintenance -temporary and transient failures - weather effects - common mode failures -Evaluation of various indices.

Text Books:

1. Roy Billinton and Ronald N. Aallan "Reliability Evaluation of Engineering Systems", Concepts and Techniques, 2nd Edition Springer International Edition, 1992
2. Roy Billinton and Ronald N. Aallan "Reliability Evaluation of Power Systems", 2nd Edition, BS Publications, 1996.

Suggested Reading:

1. J. Endrenyi, " ReliabilityModeling in Electrical Power Systems", Wiley Inter science publications,1978.

16EE E21

SMART GRID

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To study the importance of smart grid and components of smart grid and tools for smart grid design
2. To understand the stability analysis tools for smart grid and importance of state estimation
3. To know various computing tools for smart grid design.

Course outcomes: After completion of this course, students will be able to:

1. Recognize the concept of Smart Grid communication and Measurement
2. Comprehend the concept of tools used for Smart Grid Design
3. Know the concept of Stability Analysis Tools for Smart Grid
4. Understand the concept of State Estimation
5. Understand the transmission and distribution management systems

UNIT-I:

Today's Grid versus the Smart Grid, Smart Grid communication and Measurement, Communication and measurement, Monitoring, PMU, Smart meters and Measurement Technologies: Wide area monitoring systems(WAMS),Phasor Measurement Units (PMU) ,Smart meters,Smart applications,Advanced Metering Infrastructure(AMI),GIS and Google mapping Tools ,Multiagent systems (MAS) Technology: Multiagent systems for smart Grid Implementation, Multiagent Specifications, Multi agent Technique. Micro Grid and Smart Grid Comparison

UNIT-II

Performance analysis tools : Analysis of Smart grid Design, Load flow studies: GS Method, Newtonrap son Method, Fast Decoupled Method , Distributed Load Flow Methods, Congestion management effect, contingencies and their classification : Steady state contingency analysis, Performance Indices, Sensitivity Based Approaches.

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UNIT-III

Stability Analysis Tools: Definition of stability in power system, voltage stability assessment: voltage stability and voltage collapse, Classification of Voltage Stability, static stability, Dynamic stability, Analysis Techniques for dynamic voltage stability studies, voltage stabilityassessment Techniques, Angle stability Assessment, Transient stability

UNIT-IV

State Estimation: State estimation, Formulation of Weighted Least Square Estimation (WLS),Detection And Identification Of Bad Data ,State estimation for smart grid, Dynamic state estimation, observability analysis

UNIT-V

Transmission and Distribution Management Systems: Data Sources, Energy Management System, Wide Area Applications, Visualization Techniques, Data Sources and Associated External Systems, SCADA, Customer Information System, Modeling and Analysis Tools, Distribution System Modeling, Topology Analysis, System Monitoring, Operation, Management, Outage Management System.

Text Books:

1. James Momoh, “Smart Grid Fundamentals of Design and Analysis” IEEE Press, Wiley Publications, 2012
2. Bharat Modi, Anuprakash, Yogesh Kumar, “Fundamentals of Smart grid Technology”, Katson publishers, 2015 .

Suggested Reading:

1. Salman K Salman, Introduction to the Smart grid: concepts, technologies and evolution, IET publications, 2017
2. Clark W Gellings, The Smart grid: Enabling Energy efficiency and demand response, The fairmount press Inc, 2009
3. Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, Smart Grid, Wiley Publications, 2012.

16EE E22

Program Specific Elective-6
EMBEDDED SYSTEM DESIGN

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the basics of embedded processing.
2. To understand the concept of Real time operating systems.
3. To understand a design of embedded architecture

Course Outcomes: After completion of this course, students will be able to:

1. Acquire the knowledge on ARM processor
2. Have knowledge on RTOS functional units
3. Have basic knowledge on embedded programming
4. Have basic knowledge on advanced embedded processors
5. Have a basic knowledge on development of embedded system

UNIT–I

Introduction to Embedded Systems: An Embedded system, Classification, processor in the system, other hardware units, structural units in a processor, processor selection for an embedded system, memory devices, memory selection for an embedded system, introduction to ARM processors.

UNIT–II

Devices and Buses: I/O devices, Serial communication using IIC and CAN buses, advanced I/O buses between the networked multiple Devices, Device drivers: Classification, Parallel port device drivers in a system, Serial port device drivers in a system.

UNIT–III

Interprocess communication and synchronization of processes, Task and Threads: Multiple processes in an application, problem of sharing data by multiple tasks and routines, Embedded programming in C++ and Java.

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UNIT – IV

Real time Operating Systems: Operating system services, Real time operating system services, interrupt routines in RTOS Environment, RTOS Task scheduling, embedded Linux internals, OS Security issues, Mobile OS.

UNIT – V

Hardware-Software Co-Design in an Embedded System: Embedded system project Management, Embedded system Design and Co-Design issues in system development process. Design cycle in system development phase for an embedded system, Emulator and ICE, Use of software tools for development of Embedded systems, Case studies of programming with RTOS (Examples: Automatic chocolate vending machine, vehicle tracking system, Smart card).

Text Books:

1. Raj Kamal, "Embedded Systems" Architecture, Programming and Design, TMH, 2006.
2. Jonathan W Valvano, "Embedded Micro Computer Systems" Real Time Interfacing, Books / cole, Thomson learning 2006.
3. Arnold S Burger, "Embedded System Design" An Introduction to Processes, Tools and Techniques by CMP books, 2007.

Suggested Readings:

1. David.E. Simon, "An Embedded Software Primer", Pearson Edition, 2009.
2. Andrew N.sloss, Dominic Symes, Chris Wright, "ARM System Developer's guide", Elsevier publications 2005.

16EE E23

ADVANCED POWER SYSTEM PROTECTION

Instruction	3 Hours Per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Study the operating principles and application aspects of static relays
2. Understand the protection of bus-bars & various neutral grounding techniques.
3. Disseminate with the general principles of pilot protection and travelling wave relays.

Course Outcomes: After completion of this course, students will be able to:

1. Comprehend the basic components of static relays and their characteristics
2. Understand the operating principles of different distance relays.
3. Acquaint with the various grounding methods & bus-bar protection
4. Explicate the principles of transformer protection and auto re-closures.
5. Know various types of pilot protection schemes, their adaptability and basic principle of travelling wave relays.

UNIT-I

Static Relays: Advantages and disadvantages, Comparators, Amplitude and Phase comparison schemes, Duality between Amplitude and phase comparators, General equation for comparators for different types of relays, Static comparators, Coincidence circuits, Phase splitting methods, Hall effect comparators, Operating principles, Use of level detectors, Time delay circuits, Filters, Thyristors, Triggering circuits and DC power supplies.

UNIT-II

Static Relay Hardware: Operating principles, Static time current relays, Differential relays, Distance relays, Quadrilateral relay, Elliptical relay, Relay response, Principle of R-X diagram, Effect of arc resistance, source impedance and line length on the performance of distance relay, Power swings, Loss of synchronism and its effect on distance relays.

UNIT-III

Bus Bar protection and Grounding: Bus bars, Differential protection. Neutral Grounding: Grounded and Underground Neutral Systems, Effects of Un grounded Neutral on system permanence. Methods of Neutral Grounding: Solid, Resistance, Reactance – Arcing Grounds and Grounding Practices.

UNIT-IV

Transformer Differential Protection: Effect of magnetizing inrush currents, Grounding transformers, Switched schemes, Auto-reclosing, Single and multi-shot auto reclosing, Single pole and three pole auto reclosing.

UNIT-V

Pilot Wire and Carrier Protection: Circulating current scheme, Balanced Voltage scheme, Translay scheme, Half wave comparison scheme, Phase comparison carrier current protection, Carrier transfer scheme, Carrier blocking scheme, Digital protection of EHV/ UHV transmission line based upon traveling wave phenomena.

Text Books:

1. Badriram and Viswakarma D.N., 'Power System Protection and Switchgear', Tata McGraw Hill, April, 2001.
2. Madhavarao T.S., 'Power System Protection Static relays with microprocessor applications', Tata McGraw Hill, 2001.
3. A.T. Johns and S.K. Salman, 'Digital protection for power systems', IEE series, 1989.
4. Stanley H Horowitz, A.G. Phadke, 'Power system relaying', 4th Edition, Wiley publications, 2014.

Suggested Reading:

1. Warrington A.R. Van C, 'Protective Relays', Vol I & II Chapman & Hall, John Wiley & Sons, 1977.
2. Bhuvanesh A OZA, Nirmal kumar C. Nair, Rashesh P Mehta, Vijay H.M., 'Power system protection and Switchgear', Tata McGraw Hill, 2010.
3. J. Lewis Blackburn, Thomas J Domin, 'Protective relaying Principles and Applications', CRC press, 2014.
4. L.P. Singh, 'Digital Protection: Protective Relaying from Electromechanical to Microprocessor', John Wiley & Sons, 1994.

16EE E24

POWER SYSTEM OPERATION AND DEREGULATION

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the importance of optimal power flow and power system security.
2. To understand various methods of state estimation
3. To discuss about power system deregulation and available transfer capability of lines

Course Outcomes: After completion of this course, students will be able to:

1. Calculate the optimal power flows for the given power system
2. Carry out contingency analysis
3. Determine the state estimation of the system and difference between conventional LF and SE.
4. Understand the benefits of deregulation
5. Determine the available transfer capability of a line and know the various pricing methods in Deregulated power system.

UNIT-I:

Optimal Power Flow: Introduction, OPF formulation, OPF solution technique, Linear programming OPF, Interior point method, unit commitment solution methods, priority list method, dynamic programming method.

UNIT-II:

Power System Security: Introduction, Factors affecting power system security, Contingency analysis, AC power flow security analysis with contingency case selection, concentric relaxation, Bounding area method.

UNIT-III:

State Estimation: Introduction, Power system state estimation, Methods of Least squares, Maximum likelihood Weighted Least squares estimation, Matrix formulation, State estimation by orthogonal decomposition, detection and identification of Bad measurements, Network observability and pseudo measurements.

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UNIT-IV:

Power System Restructuring: Introduction, Motivation for restructuring of power system, Electricity market entities and model, benefits of deregulation, terminology, deregulation in Indian power sector, Operations in power markets, power pools, transmission networks and electricity markets.

UNIT-V:

ATC, Transmission Open Access and Pricing: Introduction, definitions, methods of determination of ATC, ATC calculation considering the effect of contingency analysis, Transmission open access, types of services, cost components of transmission system, transmission pricing methods, Incremental cost based transmission pricing.

Text Books:

1. K.Bhattacharya, M. Bollen and J.E. Daalder Operation of Restructured Power Systems, 1 st Edition Springer Publishers 2012.
2. P. Venkatesh, B. V. Manikandan, S. Charles Raja- A. Srinivasan, "Electrical Power Systems Analysis, Security, Deregulation"– PHI, 2012.

Suggested Reading:

1. Md Shahidephpour and M. Alomoush, 'Restructured Electrical Power Systems', Marcel Dekker Inc, 2001.
2. T.K.Nagsarkar, M.S.Sukhija, Power System Analysis, Illustrated Edition, Oxford publications, 2007
3. A. J. Wood &B.F.Woollenberg- Power Generation, Operation and Control, 3rd Edition. John Wiley, 2013.

16EE E25

ELECTRICAL ESTIMATION AND COSTING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To emphasize the estimation and costing aspects of all electrical equipment, installation and designs on the cost viability.
2. To design and estimation of wiring
3. To design overhead and underground distribution lines, substations and illumination

Course Outcomes: After completion of this course, students will be able to:

1. Understand the design considerations of electrical installations.
2. Design electrical installation estimation and costing for buildings and small industries.
3. Design electrical installation estimation and costing for commercial and small industries.
4. Design electrical installation estimation and costing for transmission and distribution systems.
5. Identify and design the various types of light sources for different applications.

UNIT-I

Electrical Wiring: Different types of wires, wiring system and wiring methods, Comparison of different types of wirings. Specifications of Different types of wiring materials, Accessories Different types of wiring appliances and tools. Domestic and industrial panel wiring. Different types of wiring circuits. I.E. rules for wiring, Electricity supply act-1948.

UNIT-II

Residential Building Electrification: General Rules guidelines for wiring of residential installation and positioning of equipments, Principles of circuit design in lighting and power circuits Procedures for designing the circuits and deciding the number of circuits, Method of drawing single line diagram. Selection of type of wiring and rating of wires and cables Load calculations and selection of size of conductor, Selection of rating of main switch Distribution board, protective

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switchgear ELCB and MCB and wiring accessories, Earthing of residential Installation.

UNIT-III

Electrification of Commercial Installation: Concept of commercial installation, Differentiate between electrification of residential and commercial installation, Fundamental considerations for planning of an electrical installation system for commercial building, Design considerations of electrical installation system for commercial building, Load calculation and selection of size of service connection and nature of supply, Deciding the size of the cables, bus bar and bus bar chambers, Mounting arrangements and positioning of switchboards, distribution boards main switch etc, Earthing of the electrical installation, Selection of type wire, wiring system and layout.

UNIT-IV

Design And Estimation of Overhead Transmission & Distribution Lines: Introduction, Typical AC electrical power system, Main components of overhead lines, Line supports. Factors governing height of pole, Conductor materials, Determination of size of conductor for overhead transmission line, Cross arms, Pole brackets and clamps, Guys and Stays, Conductors configuration spacing and clearances, Conductors configuration spacing and clearances, Span lengths, Overhead line insulators, Insulator materials, Types of insulators, Lightning Arrestors, Phase plates, Danger plates, Anti climbing devices, Bird guards, Beads of jumpers. Anti climbing devices, Beads of jumpers. Muffs, Points to be considered at the time of erection of overhead lines, Erection of supports, setting of stays, Fixing of cross arms, Fixing of insulators, Conductor erection, Repairing and jointing of conductor, Dead end clamps, Positioning of conductors and attachment to insulators Jumpers, Tee-offs, Earthing of transmission lines. Guarding of overhead lines, Clearances of conductor from ground Spacing between conductors, Testing and commissioning of overhead distribution lines, some important specifications.

UNIT-V

Design and Estimation of Substations: Introduction, Types of substations, Outdoor substation – Pole mounted type, Indoor substations – Floor mounted type.

Design and Estimation of Illumination Schemes: Introduction, Terminology in illumination, laws of illumination, various types of light sources, estimation and costing of lighting schemes.

Text Books:

1. "K. B. Raina, S. K. Bhattacharya", "Electrical Design Estimating and Costing", New Age International Publisher, 2010.
2. "Er. V. K. Jain, Er. Amitabh Bajaj","Design of Electrical Installations", University Science Press.
3. "Gupta J. B., Katson, Ludhiana", "Electrical Installation, estimating and costing", S. K. Kataria and sons, 2013.
4. "Surjit Singh", "Electrical Estimation and Costing". Dhanpatrai & Co. second edition, 2001.

Suggested Reading:

1. Code of practice for Electrical wiring installations (System voltage not exceeding 650 volts), Indian Standard Institution, IS: 732-1983.
2. Guide for Electrical layout in residential buildings, Indian Standard Institution, IS: 4648-1968.
3. Electrical Installation buildings Indian Standard Institution, IS: 2032.
5. Code of Practice for earthling, Indian Standard Institution, IS: 3043-1966.
6. Code of Practice for Installation and Maintenance of induction motors, Indian Standard Institution, IS: 900-1965.
7. Code of Practice for electrical wiring, Installations (system voltage not exceeding 650 Volts), Indian Standard Institution, IS: 2274-1963.

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16EG O01

Open Elective- II

TECHNICAL WRITING SKILLS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The course will introduce the students to

1. Process of communication and channels of communication in general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

Course Outcomes : After successful completion of the course students will be able to

1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

Unit I

Communication – Nature and process.

Channels of Communication – Downward, upward and horizontal communication. Barriers to communication.

Technical Communication – Definition, oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

Unit II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing. Abstract and specific words. Sentence structure and requisites of sentence Construction. Paragraph length and structure.

Unit III

Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters.

Technical Articles : Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

Unit IV

Technical Reports : Types, significance, structure, style and writing of reports. Routine reports, Project reports.

Technical Proposals : Definition, types, characteristics, structure and significance.

Unit V

Mechanics of Meetings : Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.

Technical Presentations : Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Text Book :

1. Meenakshi Raman & Sangeeta Sharma, **"Technical Communications-Principles and Practice"**, Oxford University Press, Second Edition, 2012.
2. 1.M Ashraf Rizvi, **"Effective Technical Communication"**, Tata McGraw Hill Education Pvt Ltd, 2012.

Suggested Reading :.

1. Kavita Tyagi & Padma Misra, **"Basic Technical Communication"**, PHI Learning Pvt Ltd, 2012.
2. R.C Sharma & Krishna Mohan, **"Business Correspondence and Report Writing"**, Tata McGraw Hill, 2003

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. https://www.technical-writing-training-and-certification.com/
3. https://academy.whatfix.com/technical-writing-skills

16ME O04

INTELLECTUAL PROPERTY RIGHTS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will learn
1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

Outcomes: At the end of the course, a student
1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT

Patents: Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT-III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.

Unfair Competition: What is unfair competition. Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications", Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications", Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan, "Law of Copyright and Industrial Designs", Eastern law House, Delhi 2010

Suggested Reading:

1. W.R1 Cronish, "Intellectual Property; Patents, copyright, Trad and Allied rights", Sweet & Maxwell, 1993.
2. P. Narayanan, "Intellectual Property Law", Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs", 4/e, Sweet, Maxwell,.

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16ME O08

INDUSTRIAL ADMINISTRATION AND FINANCIAL MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: Students able to learn

1. Various types of business organizations and organization structures and importance of plant location and plant layout.
2. Importance of industrial engineering techniques like method study and work measurement.
3. The significance of quality control and production planning and control
4. The importance of project management techniques
5. The total cost of a product based on elements of cost

Outcomes: At the end of the course, the students will be able to

1. Understand the role of different types of business organizations along with the need and importance of various types of layouts used in manufacturing industries
2. Apply the techniques of method study and work measurement in industry to enhance productivity
3. Understand the importance of quality control and plot the control charts
4. Apply the techniques of project management in industry
5. Calculate the total cost of the product based on its elements.

UNIT-I

Industrial Organization: Definition of an organization, types of various business organizations, organization structures and their relative merits and demerits, functions of management.

Plant location and layouts: Factors affecting the location of plant and layout, types of layouts and their merits and demerits.

UNIT-II

Work study: Definitions, objectives of method study and time study, steps in conducting method study, symbols and charts used in method study, principles of motion economy, calculation of standard time by time study and work sampling, performance rating factor, types of ratings, jobs evaluation and performance appraisal, wages, incentives, bonus, wage payment plans

UNIT-III

Inspection and quality control: Types and objectives of inspection, S.Q.C., its principles. Quality control chart and sampling plans, quality circles, introduction to ISO.

Production planning and control: Types of manufacture, types of production, principles of PPC and its function, production control charts.

UNIT-IV

Optimization: Introduction to linear programming and graphical solutions, assignment problems.

Project Management: Introduction to CPM and PERT, determination of critical path.

Material Management: Classification of materials, materials planning, duties of purchase manager, determination of economic ordering quantities, types of materials purchase.

UNIT-V

Cost accounting: Elements of cost, various costs, types of overheads, break even analysis and its applications, depreciation, methods of calculating depreciation fund, nature of financial management, time value of money, techniques of capital budgeting and methods, cost of capital, financial leverage.

Text Books:

1. Pandey I.M. , "Elements of Financial Management", Vikas Publ. House, New Delhi, 1994.
2. James C Van Horne, John M Wachowicz, Jr., "Fundamentals of Financial Management", 13/e, Prentice Hall Financial Times.
3. Khanna O.P., "Industrial Engineering and Management", Dhanapat Rai & Sons.

Suggested Reading:

1. S.N. Chary, "Production and Operations Management", 3/e, Tata McGraw Hill, 2006.
2. Paneer Selvam, "Production and Operations Management", Pearson Education, 2007.
3. Joseph Monk, "Operations Management", TMH Publishers, New Delhi, 2004.
4. Buffa Elwood S, "Modern Production /Operations Management", John Wiley Publishers, Singapore, 2002.
5. Everrete E. Adama & Ronald J. Ebert, "Production & Operations Management", 5/e, Prentice Hall of India, 2005.
6. S.D. Sharma, "Operations Research" ,Kedarnath, Ramnath & Co., Meerut, 2009.

16CS O03

IOT AND APPLICATIONS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Programming Basics.

Course Objectives: The main objectives of this course are:

1. Impart necessary and practical knowledge of components in Internet of Things.
2. Understand working of IoT Systems.
3. Develop skills required to build IoT based systems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand Internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Remotely monitor data and control devices.
4. Develop real time IoT based projects.
5. Advance towards research based IoT.

UNIT – I

Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators and Types of Actuators.

UNIT – II

Basics of Networking: Functional Components of IoT, IoT interdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

UNIT – III

IoT Hardware Components: Computing (Arduino/Raspberry Pi), Communication, Sensors, Actuators, I/0 interfaces, Programming API's (for Arduino/ Raspberry Pi).

UNIT – IV

IoT Application Development: Solution framework for IoT applications-Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, Authorization of devices

UNIT – V

IoT Systems and Applications: Smart Lighting, Weather Monitoring System, Weather Reporting Bot, Forest Fire Detection, Alcohol Detection System, Smart Parking Environment., Drip-irrigation, Biological water treatment system, Work flow Automation in Industries, Smart Intrusion Detection System, monitoring space risks and hazardous conditions in industrial regions like underground tanks , trap door margins.

Text Books:

1. Raj and Anupama C. Raman,"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.

Online Resources:

1. Li Da Xu, Wu He, and Shancang Li, "Internet of Things in Industries: A Survey ", IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. Gotovtsev, Pavel M., and Andrey V. Dyakov. "Biotechnology and Internet of Things for green smart city application." 2016 IEEE 3rd World Forum on Internet of Things (WF-IoT). IEEE, 2016.
3. Yanjing, Sun, et al. "Research and design of agriculture informatization system based on IOT." Journal of Computer Research and Development 48 (2011): 316-331.
4. Somov, Andrey, et al. "Bacteria to power the smart sensor applications: Biofuel cell for low-power IoT devices." 2018 IEEE 4th World Forum on Internet of Things (WF-IoT). IEEE, 2018.
5. Han, Shuqing, et al. "Analysis of the frontier technology of agricultural IoT and its predication research." IOP Conference Series: Materials Science and Engineering. Vol. 231. No. 1. IOP Publishing, 2017.

16CS O04

BASICS OF DATA SCIENCE USING R

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Probability and Statistics, basics of programming languages.

Course Objectives: The main objectives of this course are:

1. Understand R programming language.
2. Explore the programming skills needed to use R tool for statistical analysis of Biological data.
3. Analyze biological data.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understanding the basics of R, various statistical measures, algorithms useful for data analysis.
2. Explore the programming skills needed to use R tool for biological data.
3. Analyze biological data using R tool.
4. Apply classification and clustering algorithms to bilogical data.
5. Identify and work with the technologies and resources related to bioinformatics.

UNIT-I

Basics of R: Introduction, R features, setting up and exploring R environment, loading packages, types of data objects in R, working with R data objects, Controlling work space, importing files. **Programming with R:** Variables and assignment, operators, control structures, Functions-built-in, writing own functions, package creation.

UNIT-II

Data Analysis and Graphics: Data summary functions in R, Graphics technology in R, saving graphics, additional graphics packages. **Bayesian Data Analysis**: Need of Bayesian approach, Application of Bayes rule, Priors, Likelyhood functions, evaluating the posterior, Applications of Bayesian Statistics in Bioinformatics. **Stochastic Modeling**: Stochastic process and Markov Processes,

Classification of Stochastic processes, modeling a DNA sequence with Markov Chain, Characteristics of Markov Chain.

UNIT-III

MCMC using Brugs: ABO blood type example. Gibbs sampling. **Statistical Inference:** Sampling distributions, Parameter estimation, interval estimation, bootstrapping, R packages for bootstrapping. **Hypothesis Testing**: Package ctest, Binomial test, comparing variances, Wilcoxon tests, Chi-Square test, Fisher's Exact tests, Likelihood Ratio tests.

UNIT-IV

ANOVA and Regression: ANOVA table, perforating ANOVA using R, graphical analysis of ANOVA comparison, Regression: Correlations, linear regression model, fitting and testing of regression model, generalization of the model. **Working with Multivariate Data:** Multivariate data, sample statistics, display of multivariate data, outliers and principal components. Classification of discriminate analysis- classification with two population and more than two populations, cross validation classification trees.

UNIT-V

Clustering methods: measures of dissimilarities, K-means clustering, K-Medoid clustering, Hierarchical clustering-Agglomerate and divisive. **R Packages:** Bio-conductor and Seqin R.

Data Technologies: R for Data manipulation, example, Database technologies, Bioinformatics resources on the WWW.

Text Books:

1. Kim Seefeld, Ernest Linder, "Statistics using R with Biological examples", 2007 (https://cran.r-project.org/doc/contrib/Seefeld_StatsRBio.pdf).
2. Robert Gentleman, "R Programming for Bioinformatics", 1st Edition, CRC Press, 2008.

Suggested Reading:

1. Arvil Cohhlan "A Little Book of R for Bioinformatics", Release 1.0, CC ver 3.0

Online Resources:

1. https://epdf.tips/r-programming-for-bioinformatics.html
2. https://epdf.tips/r-programming-for-bioinformatics.htmlhttps://www.cyclismo.org/tutorial/R/objectOriented.html
3. https://www.w3schools.in/r/object-oriented/

Scheme of Instruction and Syllabi

of

ME I to IV SEMESTERS

of

TWO YEAR PG COURSE

in

POWER SYSTEMS & POWER ELECTRONICS
(AICTE Model Curriculum with effect from AY 2020-21)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(Autonomous Institution under UGC, Affiliated to Osmania University)
Department of Electrical and Electronics Engineering

Accredited by NBA and NAAC-UGC,

Chaitanya Bharathi (Post), Gandipet, Hyderabad–500075

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Department of Electrical and Electronics Engineering

Chaitanya Bharathi Institute of Technology (A)

Gandipet, Hyderabad-500075

Programme: PG-EEE (Power Systems & Power Electronics)

VISION and MISSION of the Institute

Vision

To be a centre of excellence in technical education and research

Mission

To address the emerging needs through quality technical education and advanced research

Quality Policy

Chaitanya Bharathi Institute of Technology imparts value based technical education and training to meet the requirements of student, industry, trade/profession, research and development organizations for self-sustained growth of society.

VISION and MISSION of EEE Department

Vision

To achieve Academic and Professional Excellence in Teaching and Research in the frontier areas of Electrical and Electronics Engineering **Vis-a -Vis** serve as a Valuable Resource for Industry and Society.

Mission

Empowering the Faculty and Student Rendezvous to Nurture Interest for Conceptual Keystone, Applied Multidisciplinary Research, Inspiring Leadership and Efficacious Entrepreneurship culture, Impeccable Innovation in frontier areas to be synergetic with Environmental, Societal and Technological Developments of the National and International community for Universal Intimacy.

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M1: Emphasis on providing Strong Theoretical Foundation & Engineering Leadership Eminence, infusion of Creativity and Management skill while maintaining Ethics and Moral for Sustainable Development. (Individual development)

M2: Enable the Faculty and Student Interactions to trigger interest for Applied Multidisciplinary Research and Entrepreneurship Culture resulting in Significant Advancement of the field of Specialization with Involvement of Industries and Collaborative Educational Networks. (Sense of Ownership, Networking and Eco system Development).

M3: Extend the Conducive Neighborhoods for Innovation in frontier areas to keep pace with Environmental, Societal and Technological Developments of the National and International Community to Serve Humanity. (Service to Society, Atmanirbhar Bharat)

Programme Educational Objectives are: After the Graduation, students

PEO1: Will excel in Power System and Power Electronics area.

PEO2: Will become successful in executing software related applications.

PEO3: Will carry out research in new technologies relevant to PS & PE.

PEO4: Will develop with professional ethics, effective communication skills, and knowledge of societal impacts of computing technologies.

Programme Outcomes are: The student is expected to gain an ability:

PO1: An ability to independently carry out research /investigation and development work to solve practical problems.

PO2: Ability to write and present a substantial technical report/document.

PO3: Students should be able to demonstrate a degree of mastery in the area of PS & PE.

PO4: Ability to discriminate the capability and knowledge in order to refine the problem formulation and methods of solution which will result into an acceptable outcome.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTION AND EXAMINATION

OF

MODEL CURRICULUM (R-20)

I-Semester of ME (PS & PE)

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
THEORY									
1	20EEC101	Real Time Applications for Power Systems	3	-	-	3	40	60	3
2	20EEC102	Power Electronic Converters	3	-	-	3	40	60	3
3	20EEE10X	Program Specific Elective- I	3	-	-	3	40	60	3
4	20EEE10X	Program Specific Elective- II	3	-	-	3	40	60	3
5	20MEC103	Research Methodology and IPR	2	-	-	2	40	60	2
6	AC-1	Audit Course-I	2	-	-	2	0	50	Non-Credit
PRACTICALS									
7	20EEC103	Power Systems Lab	-	-	4	-	50	-	2
8	20EEC104	Power Electronics Simulation Lab	-	-	4	-	50	-	2
TOTAL			16	-	8	-	300	350	18

L: Lecture T: Tutorial P:Practical SEE - Semester End Examination
CIE - Continuous Internal Evaluation

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

SCHEME OF INSTRUCTION AND EXAMINATION

OF

MODEL CURRICULUM (R-20)

II-Semester of ME (PS & PE)

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
THEORY									
1	20EEC105	Power System Dynamics	3	-	-	3	40	60	3
2	20EEC106	Advanced Power Electronic Circuits	3	-	-	3	40	60	3
3	20EEE10X	Program Specific Elective-III	3	-	-	3	40	60	3
4	20EEE10X	Program Specific Elective-IV	3	-	-	3	40	60	3
5	AC-II	Audit Course-II	2	-	-	2	0	50	Non-Credit
PRACTICALS									
6	20EEC107	Power Electronics Lab	-	-	4	-	50	-	2
7	20EEC108	Power Systems Simulation Lab	-	-	4	-	50	-	2
8	20EEC109	Mini Project with Seminar	-	-	4	-	50	-	2
		TOTAL	**14**	**0**	**12**	**-**	**310**	**290**	**18**

L: Lecture T: Tutorial P: Practical SEE - Semester End Examination
CIE- Continuous Internal Evaluation

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

SCHEME OF INSTRUCTION AND EXAMINATION
OF
MODEL CURRICULUM (R-20)
III-Semester of ME (PS & PE)

S.No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L	T	P	Scheme of Examination: Duration of SEE in Hours	Maximum Marks: CIE	SEE	Credits
THEORY									
1	20EEE10X	Program Specific Elective- V	3	-	-	3	40	60	3
2	OE	Open Elective	3	-	-	3	40	60	3
PRACTICALS									
3	20EEC110	Industrial Project /Dissertation Phase 1		-	20	Viva	100	-	**10**
TOTAL			**6**	**0**	**20**	**-**	**180**	**120**	**16**

L: Lecture T: Tutorial P: Practical SEE - Semester End Examination
CIE - Continuous Internal Evaluation

SCHEME OF INSTRUCTION AND EXAMINATION
OF
MODEL CURRICULUM (R-20)
IV-Semester of ME (PS & PE)

S.No	Course Code	Title of the Course	Scheme of Instruction: Hours per week L	T	P	Scheme of Examination: Maximum Marks CIE	SEE	Credits
PRACTICALS								
1	20EEC111	Industrial Project /Dissertation Phase II	-	-	32	100	100	16
	TOTAL		**0**	**0**	**32**	**100**	**100**	**16**

L: Lecture T: Tutorial P: Practical SEE - Semester End Examination
CIE Continuous Internal Evaluation

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List of Program Specific Electives/ Open Electives/ Audit Courses

Course Code	Open Electives
20EEE101	Electrical Power Distribution System
20EEE102	Mathematical Methods for Power Engineering
20EEE103	Restructured Power Systems
20EEE107	Renewable Energy System
20EEE109	Digital Protection of Power System
20EEE110	Power Quality
20EEE114	Smart Grids
20EEE115	High Voltage Engineering

Course Code	Program Specific Electives Group-2
20EEE104	Power Semi Conductor devices & Modelling
20EEE105	Electric Drive Systems
20EEE106	HVDC
20EEE108	Artificial Intelligence Techniques for Power Systems
20EEE111	FACTS and Custom power devices
20EEE112	Switch mode & Resonant Converters
20EEE113	Energy Auditing & Management
20EEE116	Electric and Hybrid Vehicles

Course Code	Open Electives
20CSO 101	Business Analytics
20MEO101	Industrial Safety
20MEO 102	Introduction to Optimization Techniques
20MEO 103	Composite Materials
20CEO 101	Cost Management of Engineering Projects
20EEO 101	Waste to Energy

Course Code	Audit Courses – I & II
20EGA 101	English for Research Paper Writing
20EGA 102	Indian Constitution and Fundamental Rights
20EGA 103	Stress Management by Yoga
20EGA 104	Personality Development through Life Enlightenment Skills
20ECA 101	Value Education
20CEA 101	Disaster Mitigation and Management
20ITA 101	Pedagogy Studies
20EEA 101	Sanskrit for Technical Knowledge

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20EEC101 REAL TIME APPLICATIONS FOR POWER SYSTEMS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To understand the real-time computer operations of power system
2. To understand the importance of contingency analysis at planning stage for secured operation of power system.
3. To understand the concept of load forecasting in real time power system operation

Course Outcomes: After completion of this course, the student will be able to:
1. Understand the study of optimal power flows
2. Acquire knowledge of state estimation required for the real-time operation of power system
3. Describe the importance of contingency analysis at planning stage for secured operation of power system; and simulating the contingency studies with different methods.
4. Discuss the power system security and challenges in secured operation of power system in real-time environment.
5. Explain various methods and models available in power system load forecasting

UNIT-I

Optimal Power Flow: introduction to optimal power flow, Gradient method, Newton's method, Linear sensitivity analysis, linear programming method with only real power variables, linear programming with AC power flow variables and detailed cost functions, security constraint optimal power flow, interior point method, bus incremental costs

UNIT-II

State Estimation: Introduction to power system state estimation, Weighted-Least square state estimation, state estimation of AC networks, state estimation by orthogonal decomposition, Detection and identification of bad Measurements, network observability, pseudo-measurements measurements, application of state estimation.

UNIT-III

Contingency Analysis of Power system: Approximations in Contingency Analysis, Simulation of Addition and Removal of Multiple Lines in a Power System, Simulation of Tie-lines in Interconnected Power Systems, Network Reduction for Contingency Analysis, Contingency Analysis, Approximate Power Flow Method for Simulating Contingencies

UNIT-IV

Power system Security: introduction, factors affecting power system security, generator outages, transmission line outage, linear sensitivity factors, contingency selection, concentric relaxation, bounding, adaptive localization

UNIT-V

Load Forecasting: Introduction, Analytic methods, demand models, price forecasting, forecasting errors, system identification, econometric models, time series, time series model development, demand prediction.

Text Books:

1. Wood, A. J., Wollenberg, B. F., & Sheblé, G. B. 'Power Generation, operation and control', John Wiley &Sons, 2013.
2. T.K.Nagsarkar, M.S.Sukhija, 'Power system analysis', Oxford publications, 2007.

Suggested Reading:

1. J J Grainger and W D Stevenson, Power system Analysis, Mc Graw Hill 2003
2. Debs, Atif S. *Modern power systems control and operation*. Springer Science & Business Media, 2012.

20EEC102 **POWER ELECTRONIC CONVERTERS**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To understand the concepts and basic operation of transient and steady state analysis of all power electronic converters with passive and active loads.
2. To understand the operation of single phase and Three phase full–wave converters and analyse harmonics in the input current.
3. To analyze the operation of single phase Cyclo-converters, Inverters and dc–dc converters

Course Outcomes: After completion of this course, students will be able to:
1. Give a systematic approach for transient and steady state analysis of all power electronic converters with passive and active loads.
2. Know and carry out transient and steady state analysis of different power converters of different types of loads and switching sequences.
3. Analyze power electronic devices
4. Analyze and design DC-DC and DC-AC converters.
5. Analyze and design AC regulator and Cyclo converter

UNIT-I
Power Semiconductor Switched Circuits: Analysis of power semiconductor switched circuits with R, L, RL, RC loads and D.C. motor load, Battery charging circuit.

UNIT-II
Phase Controlled Rectifiers: Single-Phase and Three-Phase AC to DC converters, Single phase half controlled and fully controlled converters, operating domains of three phase full converters and semi-converters. Reactive power considerations.

UNIT-III
Non-Isolated DC-to-DC Converters (Choppers): Analysis and design of DC to DC converters, Control of DC-DC converters, Buck converters, Boost converters, Buck Boost converters, Cuck converters.

UNIT-IV
Inverters: Single phase and three phase inverters, Single phase half bridge and full bridge inverters, voltage source and current source inverters, comparison between voltage source and current source inverters, Voltage control and harmonic minimization in inverters.

UNIT-V
AC Voltage Controllers and Cyclo-Converters: AC to AC power conversion using voltage regulators, Uni-directional and Bi-directional AC voltage controllers, applications of AC voltage controllers, AC Choppers and cyclo-converters, step down and step-up cyclo converters, Consideration of harmonics, introduction to Matrix converters.

Text Books:

1. Ned Mohan, Undeland and Robbin,Power Electronics: converters, Application and design, John's Wiley and sons. Inc, Newyork.
2. M.H.Rashid,Power Electronics, Prentice Hall of India 1994.

Suggested Reading:

1. Soumitra Kumar Mandal, Power Electronics, McGraw Hill education
2. Dr. P.S. Bimbhra, Power Electronics, Khanna publications
3. M D Singh, K B Khanchandani, Power Electronics, McGraw Hill education

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20MEC 103 **RESEARCH METHODOLOGY AND IPR**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	2

Course Objectives: To make the students to

1. Motivate to choose research as career, identify various sources for literature review and report writing
2. Formulate the research problem, prepare the research design and Equip with good methods to analyze the collected data
3. Know about IPR copyrights

Course Outcomes: At the end of the course, student will be able to:

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT - I

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT - II

Literature Survey Report writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT - III

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT - IV

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT - V

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

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Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004

Suggested Reading:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India Ltd., 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010

Discussion is an exchange of intelligence, argument is an exchange of ignorance; Discussion is to find out what is right, argument is to find out who is right.

Vikasa Mantras- Vivekananda Institute of Human Excellence

20EEC103 **POWER SYSTEMS LAB**

Instruction	4 Hours per week
Continuous Internal Evaluation	50 Marks
Credits	2

Course Objectives:

1. To understand the I–V and P-V characteristics of a PV module
2. To measure the sequence reactance of synchronous machine and 3-phase transformer
3. a) To understand the characteristics of various relays
   b) To estimate efficiency, regulation and ABCD constants of 3-phase transmission line

Course Outcomes:

After completion of the course, **s**tudent will be able to:

1. Learn the measurement of sequence reactance of synchronous machine and 3-phase transformer
2. Knowledge about the relay characteristics
3. Acquire Knowledge to estimate efficiency, regulation and ABCD constants of 3-phase transmission line
4. Learn about various types of faults
5. Validate the I–V and P-V characteristics of a PV module

LIST OF EXPERIMENTS:

1. Measurement of positive, negative and zero sequence reactance of synchronous machine
2. Measurement of positive and zero sequence reactance of three-phase transformer
3. Determination of Regulation & Efficiency of a three phase transmission line
4. Determination of ABCD constants of a three phase transmission line
5. Inverse time characteristics of over current relay
6. Characteristics of static over current relay
7. Differential protection of single-phase transformer
8. Study of microprocessor based inverse current relay characteristics
9. Study of over voltage and under voltage relays
10. Study of line-to-ground, line-to-line and three-phase faults
11. Single PV module I-V and P-V characteristics with radiation and temperature changing effect.
12. I-V and P-V characteristics with series and parallel combination of modules.
13. Effect of shading and Effect of tilt angle on I-V and P-V characteristics of solar module.
14. Finding MPP by varying the resistive load by varying the duty cycle of DC-DC converter.
15. Observe the output voltage waveform of inverter in auto mode.
16. Three-phase UPQC for power quality mitigation

Note: At least **TEN** experiments should be conducted in the semester

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20EEC104 **POWER ELECTRONICS SIMULATION LAB**

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Continuous Internal Evaluation	50 Marks
Credits	2

Course Objectives:
1. To be acquainted with simulation of different power converters
2. To Simulate and compare the output of single-phase and three-phase converters with R, RL and RLE loads
3. To Simulate single and three-phase Inverters and their voltage control techniques

Course Outcomes: After completion of the course, students will be able to:
1. Acquire the knowledge of using simulation tools for power electronic converters modelling.
2. Analyze the performance of phase -controlled converters by simulation
3. Demonstrate the effects of different topologies and voltage control techniquesin inverters.
4. Simulate different dc-dc converter circuits
5. Investigate with ac-ac conversion and reactive power compensation calculations.

List of Experiments

1. Single-phase semi-converter using RL & RLE loads with and without freewheeling diode.
2. Three-phase full converter using RL load with and without LC Filter
3. Three-phase fully controlled converter fed dc drive
4. Performance analysis of phase-controlled rectifiers with source inductance(single phase and three phase)
5. Analysis of Buck and Buck-Boost converters
6. Speed control of dc drive using dc chopper
7. Analysis of single-phase and Three phase IGBT inverters
8. Single, multiple and sinusoidal PWM techniques
9. Voltage control of an inverter using unipolar & bipolar PWM techniques
10. Inverter voltage control using Space Vector Modulation
11. Single-phase current source inverter with RL load
12. Analysis of three phase AC voltage controller with R & RL loads
13. Single-phase Cyclo-converter with R & RL loads
14. Single-phase Dual converter with R & RL loads
15. Reactive power compensation using FACTS controllers
16. Simulation of matrix converter.

Note: At least **TEN** Experiments should be conducted in the semester

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20EEC105 **POWER SYSTEM DYNAMICS**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To understand and analyze the various stability concepts of the power system
2. To study the concept of modeling the synchronous machines
3. To understand the phenomenon of SSR oscillations in power system

Course Outcomes: After completion of the course, the student will be able to
1. Distinguish various stabilities issues in the power system
2. Understand the modeling of synchronous machine
3. Describe the role of Excitation, PSS and Prime Movers in improving the power system performance during disturbances
4. Analyze the small-signal stability of the power system
5. Infer the concepts of LFOs and SSR in detail

UNIT-I

Synchronous Machine Modeling: Introduction, Park's Transformation, Flux Linkage Equations, Voltage Equations, Formulation of State-Space Equations, Current Formulation, Per Unit Conversion, Normalized Voltage and Torque Equations, Torque and Power, Equivalent Circuit of a Synchronous Machine, Flux Linkage State-Space Model

UNIT-II

Stability: Definitions classification of stability, Analysis of Steady state stability, Factors affecting Steady state stability, Transient stability, Equal-area criterion, Factor influencing Transient stability, Numerical Methods for analyzing transient stability,

Definition of voltage stability, voltage security, voltage collapse, Factors contributing and affecting voltage stability and minimization of voltage collapse, analysis of voltage stability/collapse, P-V and Q-V curves

UNIT-III

System performance improvement:

Excitation systems: Requirements, elements of excitation systems, types of excitation systems, modeling of excitation systems

Power system stabilizers: Basic concepts in applying PSS, Structure and tuning of PSS

Load models: Concept of load modeling, static and dynamic load models

Prime Movers: Hydraulic turbine and governing systems, steam turbine and governing system

UNIT-IV

Small-signal stability: Fundamentals of stability of dynamic systems, Modal matrices, free motion of dynamic systems, mode shapes, small-signal analysis of SMIB, synchronizing and damping torque analysis, state equations for small-signal model.

Unit V

Sub-Synchronous Oscillations: Turbine-generator torsional characteristics, Torsional interactions with power system controls, Sub-Synchronous Resonance (SSR), counter-measures for SSR

Text Books:
1. P. M. Anderson & A. A. Fouad "Power System Control and Stability", Wiley 7 Sons, 2003
2. P. Kundur, "Power System Stability and Control", McGraw Hill Inc, 1994
3. K R Padiyar,'power system dynamics: stability and control', BS Publications, 2008

Suggested Reading:-
1. J Machowski, J Bialek& J. R W. Bumby, "Power System Dynamics and Stability", John Wiley & Sons, 1997
2. L. Leonard Grigsby (Ed.); "Power System Stability and Control", Second edition, CRC Press,2007

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20EEC106 ADVANCED POWER ELECTRONIC CIRCUITS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: Students will be able to:
1. Understand the operation of advanced power electronic circuit topologies.
2. Understand the load, switch and resonant converters.
3. Understand the modeling and design concepts of various DC-DC converters used in renewable

Course Outcomes: After completion of course Student will be able to:
1. Demonstrate the knowledge of DC isolated and non-isolated regulators
2. Demonstrate the knowledge of load and switch resonant converters
3. Demonstrate the knowledge resonant inverters
4. Model and design DC-DC converters for renewable energy conversion.
5. Apply the knowledge of dc-dc converters used in dc drives and renewable energy applications

UNIT-I
DC Regulators-I: Boost type APFC and control. Three phase utility inter phases and control-Buck, Boost, Buck-Boost SMPS, Topologies

UNIT-II
DC Regulators-II: Modes of operation –Push-Pull and Forward Converter Topologies - Voltage Mode Control. Half bridge, Full bridge and Fly-back Converters.

UNIT-III
Resonant Converters-I: Load Resonant Converter. Zero Voltage Switching Clamped Voltage Topologies.

UNIT-IV
Resonant Converters-II: Resonant DC Link Inverters with Zero Voltage Switching, High Frequency Link Integral Half Cycle Converter

UNIT-V
Application of DC-DC converters: Modeling and design of DC-DC Converters for various renewable energy conversion, Few power electronic circuits used in DC drives.

Text Books:
1. Rashid "Power Electronics" Prentice Hall India 2007.
2. G.K.Dubey et.al "Thyristorised Power Controllers" Wiley Eastern Ltd., 2005, 06.
3. Dewan & Straughen "Power Semiconductor Circuits" John Wiley & Sons., 1975.

Suggested Reading:
1. G.K. Dubey& C.R. Kasaravada "Power Electronics & Drives" Tata McGraw Hill., 1993
2. Cyril W Lander "Power Electronics" McGraw Hill., 2005.
3. B. K Bose "Modern Power Electronics and AC Drives" Pearson Education (Asia)., 2007
4. Abraham I Pressman "Switching Power Supply Design" McGraw Hill Publishing Company., 2001.

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20EEC107 **POWER ELECTRONICS LABORATORY**

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Continuous Internal Evaluation	50 Marks
Credits	2

Course Objectives:
1. To understand the performance of converters for different loads.
2. To know various methods of speed control of electric drives.
3. To identify different topologies of converters and switching methods.

Course Outcomes: After the completion of this course, students will be able to:
1. Demonstrate the effects of different loads on the performance of various phase-controlled converters and choppers.
2. Understand the various topologies and control techniques used in inverters.
3. Acquire the conversion principles of AC-AC converters
4. Analyze different power electronic based speed control techniques of electric drives
5. Utilize matrix converter for different power conversions and analyze resonant converters.

List of Experiments

1. Three-phase half controlled and full controlled bridge rectifiers withR and RL loads.
2. Analysis of chopper circuit.
3. Analysis of single-phase series-resonant inverter.
4. Three-phase Mc-Murray Bed-Ford inverter with R and RL loads.
5. Three-phase IGBT inverter with R & RL loads.
6. Closed-loop control of permanent magnet dc drive.
7. Three-phase step down cyclo-converter with R and RL loads.
8. Static rotor resistance control of slip-ring induction motor.
9. Operation of two quadrant dc drive.
10. Analysis of ZVS buck converter
11. Design and implementation of ZCS buck converter
12. Obtaining different converters using Matrix converter module
13. Speed control of SRIM using static Kramer's system.
14. Speed control of Three phase induction motor using AC-AC converter.
15. Design of a flyback converter for solar energy powered DC loads
16. Analysis of three phase cascaded multi-level inverter.

Note: At least **TEN** experiments should be conducted

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20EEC108 **POWER SYSTEMS SIMULATION LAB**

Instruction	4 Hours per week
Continuous Internal Evaluation	50 Marks
Credits	2

Course Objectives:
1. To Simulate and compare the various aspects economic load dispatch and load flows.
2. To Simulate and observe stability studies and short-circuit studies
3. To Conduct experiments on modeling of Transmission line

Course Outcomes: After completion of this course**,** students will be able to:
1. Validate the adaptability of economic load dispatch and load flow for a given situation by simulation results.
2. Acquire the knowledge about formation of Impedance and Admittance Matrices
3. Acquire the knowledge to analyze the Symmetrical and un-symmetrical fault currents
4. Acquire the knowledge to simulate various types of transmission models
5. Acquire the knowledge about Symmetrical and Unsymmetrical components for a given system.

List of Experiments:

1. Single Area and Two Area Load Frequency Control
2. Economic Load Dispatch in Power Systems
3. Formation of Z-Bus Matrix using Building Algorithm
4. Load Flow Studies Using Gauss-Seidel and Newton-Raphson Method
5. Transient Stability Studies
6. Short Circuit Analysis for unsymmetrical faults
7. Formation of Bus Admittance Matrix
8. Three Phase Short Circuit Analysis of Synchronous Machine
9. Unsymmetrical Fault Analysis for RLC loads
10. Step Response of Synchronous Machine
11. Determination of Symmetrical Components
12. Simulation of Ferranti Effect
13. Modeling of Transmission Lines
14. Solution of Swing Equation
15. Load flow studies of Distribution Systems
16. Simulation of UPQC for power quality mitigation

Note: At least **TEN** experiments should be conducted in the semester.

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20EEC109 **MINI PROJECT WITH SEMINAR**

Instruction	4 Hours per week
Semester End Examination	50 Marks
Credits	2

I. Course Objectives:
1. Motivate the students to face the challenges in which demonstration of their competence in research techniques.
2. Provide an opportunity to contribute to engineering arena in their own form.

II. Course Outcomes: On successful completion of the course students will be able to:
1. **Organise** the literature review to identify and formulate the engineering problem
2. **Design** engineering solutions to simple problems utilizing modern tools and methods
3. **Demonstrate** a sound technical knowledge of their selected mini project topic
4. **Communicate** with engineers and the community to have the conscious of surroundings
5. **Adapt** the skills and attitudes of a Professional Engineer.

III. General Instructions:
1. Mini Project is of 14 week duration out of which one week prior reading, twelve weeks of active research and final week for presentation of their work for assessment.
2. Each student will be allotted to a faculty supervisor for mentoring.

IV. Methodology:
1. The student can select either mathematical modeling based / experimental investigations or numerical modeling.
2. All the investigations are clearly stated and documented with reasons / explanations.
3. The project should contain
   i. A clear statement of research objectives
   ii. Background work
   iii. Literature review
   iv. Techniques used
   v. Prospective deliverables
   vi. Benefit from this research
   vii. Detailed discussion on results
   viii. Conclusions and references

V. Assessment:
1. 50% of the marks for oral presentation which will take place at the end of the semester.
2. Evaluation will be done by a committee consisting of supervisor, one senior faculty and Head of the department or his nominee.
3. Evaluation will be carried out based on 'RUBRIC' (which will be supplied by the dept.)
4. 50% of the marks for scientific report on the project.
5. Report should be written as per standard journal format. The repertoire of the report content can be taken from the department.

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20EEC110 INDUSTRIAL PROJECT / DISSERTATION PHASE- I

Instruction	20 Hours per week
Semester End Examination	100 Marks
Credits	10

Course Objectives: At the end of the course:
1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.
3. Students will learn to write technical reports.
4. Students will develop oral and written communication skills to present.
5. Student will defend their work in front of technically qualified audience.

Course Outcomes: On successful completion of the course students will be able to:
1. **State** research questions related to main problem and identify the Research methods
2. **Identify** literature for review.
3. **Integrate** theory and practice.
4. **Apply** knowledge and understanding in relation to the agreed area of study.
5. **Communicate** in written form by integrating, analysing and applying key texts and practices

Guidelines:
1. The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.
2. Seminar should be based on the area in which the candidate has undertaken the dissertation work.
3. The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.
4. The preliminary results (if available) of the problem may also be discussed in the report.
5. The work has to be presented in front of the committee consists of Head, Chairperson-BoS, Supervisor and Project coordinator.
6. The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

Guidelines for the award of Marks: Max. Marks: 100		
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

Note: Department committee has to assess the progress of the student for every two weeks.

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20EEC111 INDUSTRIAL PROJECT / DISSERTATION PHASE- II

Instruction	32 Hours per week
Semester End Examination	100 Marks
Continuous Internal Evaluation	100 Marks
Credits	16

Course Objectives: At the end of the course:
1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
2. Students will be able to design and develop an experimental set up/ equipment/test rig.
3. Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
4. Students will be able to either work in a research environment or in an industrial environment.
5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

Course Outcomes: On successful completion of the course students will be able to:
1. **Contribute** to Research and Development work.
2. **Apply** a holistic view to critically, independently and creatively to identify, formulate and deal with complex issues.
3. **Evaluate** critically different engineering/Technological solutions.
4. **Integrate** knowledge critically and systematically
5. **Develop** the ethical aspects of Research work.

Guidelines:
1. It is a continuation of Project work started in semester III.
2. The student has to submit the report in prescribed format and also present a seminar.
3. Develop strong communication skills to defend their work in front of technically qualified audience
4. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.
5. The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner (HoD and BoS Chair Person) guide/co-guide.
6. The candidate has to be in regular contact with his/her guide/co-guide.

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Guidelines for awarding marks in CIE:		Max. Marks: 100
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Review Committee	05	Review 1
	10	Review 2
	10	Review 3
	15	Final presentation with the draft copy of the report standard format
	10	Submission of the report in a standard format
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Analytical / Programming / Experimental Skills
	10	Report preparation in a standard format

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal	20	Power Point Presentation
	40	Quality of thesis and evaluation
Examiner(s) together	20	Quality of the project 1. Innovations 2. Applications 3. Live Research Projects 4. Scope for future study 5. Application to society
	20	Viva-Voce

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Programme Specific Electives

20EEE101 ELECTRIC POWER DISTRIBUTION SYSTEM

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To study sub-transmission, Distribution substations
2. To understand the philosophy of Distribution Automation and SCADA
3. To explore with the optimization aspects of distribution system

Course Outcomes: After completion of the course, students will be able to:
1. Acquire knowledge of sub-transmission, Distribution substations
2. Understand Distribution voltage regulation
3. Discuss the Distribution automation and its application in practice
4. Explain the concept of optimization in distribution automation
5. Demonstrate the need and functioning of SCADA system

UNIT-I

Sub-Transmission Lines & Substations: Types of sub transmission, Distribution substation, Bus schemes, Substation location, Rating of substation, Calculation of voltage drops with primary feeders, Derivation of the K constant, Application curves, Interpretation of the Percentage Voltage drop formula.

UNIT-II

Primary Feeders: Types of primary feeders, Primary feeder loading, Tie lines, Design of radial primary feeders, Voltage drop calculations by ABCD constants, Uniformly distributed load, Non uniformly distributed load, Distribution Feeder Analysis

Secondary Feeders: Secondary voltage levels, Present design practice, Secondary Banking, Economic design of secondaries, Total annual cost equation.

UNIT-III

Distribution voltage regulation: Three-phase balanced and non-three-phase primary lines, analysis distribution and equipment costs, introduction to Distribution system voltage regulation, voltage standards, voltage control, feeder-voltage regulators, line-drop compensation, capacitor automation, voltage fluctuations

UNIT-IV

Distribution Automation: Introduction, Project planning, Definitions, Communication, Sensors, Supervisory Control and Data Acquisition Systems (SCADA), Consumer Information Service(CIS), Geographical Information System (GIS), Automatic Meter Reading (AMR), Automation system.

Optimization: Costing of schemes, optimal placement of Capacitors, Optimum size of line conductor in Distribution Systems, Restoration and Reconfiguration of network, Economic loading of distribution transformers, Optimal switching device placement.

UNIT-V

SCADA: Introduction, Block Diagram, components of SCADA, Functions of SCADA, SCADA applied to distribution automation, Advantages of Distribution Automation through SCADA, Communication protocols in SCADA systems

Text Books:

1. Turan Gonen, Electric Power Distribution System Engineering, CRC Press, 2nd Edition, 2008
2. A.S. Pabla, Electric Power Distribution, Tata McGraw Hill Publishing Co. Ltd., 5th Edition, 2004

Suggested Reading:

1. M.K. Khedkar, G.M. Dhole, A Text Book of Electric power Distribution Automation, University Science Press, New Delhi,2010
2. Anthony J Pansini, Electrical Distribution Engineering, CRC Press, 1992
3. James Momoh, Electric Power Distribution, automation, protection & control, CRC Press, 2007

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20EEE102 MATHEMATICAL METHODS FOR POWER ENGINEERING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To understand the relevance of mathematical methods to solve engineering problems.
2. To understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand.
3. To understand how to model and solve problems using linear and nonlinear programming with and without constraints

Course Outcomes: After completion of the course, students will be able to:
1. Recognize and identify the nature of the mathematical problems that are commonly encountered in power engineering
2. Knowledge about vector spaces, linear transformation, Eigen values and eigenvectors of linear operators
3. To learn about linear programming problems and understanding the Simplex method for solving linear programming problems in various fields of science and technology
4. Acquire knowledge about nonlinear programming and various techniques used for solving constrained and unconstrained nonlinear programming problems
5. Understanding the concept of random variables, functions of random variable and their probability distribution

UNIT-I
Vector spaces, linear transformations, Matrix representation of linear transformation

UNIT-II
Eigen values and Eigen vectors of linear operator

UNIT-III
Linear Programming Problems, Simplex Method, Duality, Non Linear Programming problems

UNIT-IV
Unconstrained Problems, Search methods, Constrained Problems

UNIT-V
Lagrange method, Kuhn-Tucker conditions, random Variables, distributions, Independent Random Variables

Text Books:
1. Kenneth Hoffman and Ray Kunze,Linear Algebra, 2nd Edition, PHI, 1992
2. Erwin Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, 2004
3. Irwin Miller and Marylees Miller, John E. Freund's, Mathematical Statistics, 6th Edn, PHI, 2002
4. J. Medhi, Stochastic Processes, New Age International, New Delhi., 1994

Suggested Reading:
1. A Papoulis,Probability, Random Variables and Stochastic Processes, 3rd Edition, McGraw Hill, 2002
2. John B Thomas,An Introduction to Applied Probability and Random Processes, John Wiley, 2000
3. Hillier F S and Liebermann G J, Introduction to Operations Research, 7th Edition, McGraw Hill, 2001
4. Simmons D M,Non Linear Programming for Operations Research, PHI, 1975

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20EEE103 **RESTRUCTURED POWER SYSTEMS**

Instruction	3 Hour per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To understand open access and operation of power system in deregulated and competitive environment.
2. To understand the role of ISO in pool markets, Bilateral markets and transmission pricing issues
3. To understand different aspects of managing ancillary services and open access same time information system.

Course Outcomes: After completion of the course, students will be able to:
1. understand the operation of power system in de-regulated and competitive environment
2. Discuss operation and planning policies, in deregulated environment.
3. Describe the transmission pricing methodologies.
4. Distinguish different ancillary services provided by the ISO
5. Explain open access same-time information system.

UNIT-I

Introduction to Power System Deregulation: Operation of vertically integrated power systems, Fundamental of Restructured systems, Benefits of deregulation, Power pools, Energy Brokerage system, Electricity market models, Market models based on contractual arrangements, Market architecture, Spot market, Day-ahead market and retail market, Models for trading arrangements. Congestion management.

UNIT-II

Power System Operation in Competitive Environment: Operational planning activities of ISO, ISO in pool markets, ISO in bilateral markets, Operational planning activities of a GENCO, Unit commitment in deregulated environment, Competitive bidding. Risk assessment.

UNIT-III

Transmission Pricing Issues: Power wheeling, transmission open access, cost components in transmission, pricing of power transactions, Transmission cost allocation methods, Postage stamp method, Contract path method, MW-Mile method, MVA-Mile method, Unused transmission capacity method, Comparison of cost allocation methods.

UNIT-IV

Ancillary Services Management: Types of ancillary services, classification of ancillary services, load generation balancing related services, frequency regulation, load following, voltage control and reactive power support service, black start capability service, Synchronous generators as ancillary service providers. Standard market design.

UNIT-V

Open Access Same-time Information System: Structure of oasis, Posting of information, Transfer capability on oasis, Definitions- ATC, TTC, TRM, CBM, Methodologies to calculate ATC. Developments in India, IT applications in Restructured markets.

Text Books:

1. Lai, L.L. (Editor.), ‘Power System Restructuring and Deregulation’, John Wiley and Sons Ltd., 2001.
2. Bhattacharya, K., Bollen, M.H.J., and Daalder, J.E., ‘Operation of Restructured Power Systems’, Kluwer Academic Publishers. 2001.

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Suggested Readings:

1. LorrinPhilipson, H. Lee Willis, "Understanding electric utilities and de- regulation", Marcel Dekker Pub.,1998.
2. Steven Stoft, "Power system economics: designing markets for electricity", John Wiley and Sons, 2002.
3. M.Ilic, F.Galiana and L.Fink, 'Power System Restructuring Engineering and Economics', Kluwer Academic Publishers 1998.
4. Md Shahidephpour & M. Alomoush, 'Restructured Electrical Power Systems', Marcel Dekker Inc, 2001.

Time is what we need most, but what we use worst; Most of the misfortunes in our life are due to misused time.

Vikasa Mantras- Vivekananda Institute of Human Excellence

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20EEE107 RENEWABLE ENERGY SOURCES

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To learn various renewable energy sources
2. To understand the working principles and implementation aspects of solar and wind energy sources.
3. To understand power electronics interface and power quality problems with grid

Course Outcomes: After completion of the course, students will be able to:
1. Acquire the knowledge on design of solar PV systems
2. Implement the concepts of wind power generation
3. Demonstrate the suitability of non-conventional energy for grid connection
4. Understand the working of distributed generation system in autonomous/grid connected modes
5. Analyze economic aspects of power generation and its power quality issues

UNIT-I

Generation of Electrical Energy: Introduction, Conventional and renewable sources of energy, Distributes and central station generation, DG technologies, Advantages and disadvantages of distributed generation, introduction to hydro, tidal, wave, Geothermal and biomass energy.

UNIT-II

Solar Energy Conversion: Solar radiation and its measurements, Types of solar collectors, Combined heat and power, Solar thermal power plant, Components of solar PV system, Efficiency and limits, Design of solar PV Hybrid system, Standalone and Grid connected systems

UNIT-III

Wind Energy: Power in the wind, Types of wind turbines, Components of wind mill, operation of wind turbines, Wind energy extraction, Types and design of wind turbine rotor, modes of wind power generation, Selection of optimum WEG, Grid interfacing of wind farm, Methods of grid connection, Properties of grid system.

UNIT-IV

Integration of grids & Power Quality: Interface with grid, direct and power electronics coupling, Impact of type of interface, Power Quality issues, Impact of distributed generation, Power Quality disturbances

UNIT-V

Economics of power generation: Transmission system operation, Protection of distributed Generators, Economics of distributed generation, Case studies, solar electricity in Sagar Island, Potential of wind energy in India.

Text Books:

1. RanjanRakesh , D.P.Kothari, Singal K C, “Renewable Energy Sources And Emerging Technologies” 2nd Edition Printice Hall Of India 2011
2. Math.H.Bollen, Fainan Hassan, “Integration Of Distributed Generation In The Power System” Wiley IEEE Press, July 2011

Suggested Reading:

1. Loi Lei Lai, Tze Fun Chan, “ Distributed Generation: Induction And Permanent Magnet Generators” October 2007, Wiley IEEE Press
2. Roger A Messenger, Amir Abtahi, :” Photovoltaic Systems Engineering” 3rd Edition 2010
3. James A Manwell, John G McGowan Antony L Rogers , “Wind Energy Explained: Theory, Design And Application” John Wiley And Sons 2010

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20EEE109 DIGITAL PROTECTION OF POWER SYSTEM

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To study the architecture and the required mathematical background for the design and development of digital relays
2. To Explore the basic elements in digital relays and understand various algorithms used in digital protection
3. To understand the application of various algorithms for the digital protection of practical power system.

Course Outcomes: After completion of the course, students will be able to:
1. Recognize the need and architecture of digital relays
2. Comprehend the application of mathematics in power system protection
3. Describe the importance of every element of digital relay
4. Distinguish various mathematical algorithms used for the estimation of power system parameters
5. Explain various algorithms used for the digital protection of power system.

UNIT-I
Digital Relays: Evolution of digital relays, Advantages, Architecture of digital relays, Performance and operational characteristics of digital protection
Mathematical Background: Finite difference techniques, Forward, backward and central difference interpolation, Numerical differentiation, Curve fitting and smoothing, Fourier analysis, Walsh function analysis.

UNIT-II
Basic Elements of Digital Protection: Signal conditioning: transducers, surge protection, analog filtering, analog multiplexers, Conversion subsystem: the sampling theorem, signal aliasing Error, sample and hold circuits, multiplexers, analog to digital conversion, Digital relay subsystem filtering concepts of the digital relay as a unit consisting of hardware and software

UNIT-III
Sinusoidal-Wave-Based Algorithms: sample, first, second derivative techniques, two-sample and three-sample techniques, Fourier-analysis-based algorithms, walsh-function-based techniques

UNIT-IV:
Algorithms based on Least Squares and Differential Equation:
Least Squares-based Algorithm: Integral LSQ fitting, Power series LSQ fitting, Multi-variable series LSQ
Differential Equation-based Algorithm: Representation of Transmission line, differential equation protection, simultaneous equation techniques,

UNIT-V:
Digital Protection:
Digital Protection of Transformers: Principles of protection, FIR-filter based algorithms, Least-square curve fitting based algorithms, Fourier-based Algorithms
Digital Protection Transmission Lines: current-based differential Protection, composite voltage and current-based protection schemes

Text Books:
1. A.T. Johns and S. K. Salman, “Digital Protection of Power Systems”, IEEE Press,1999
2. S.R.Bhide “Digital Power System Protection” PHI Learning Pvt.Ltd.2014

Suggested Reading:
1. Rebizant, Waldemar, Janusz Szafran, and Andrzej Wiszniewski, "Digital signal processing in power system protection and control" Springer, 2011.
2. A.G. Phadke and J. S. Thorp, “Computer Relaying for Power Systems”, Wiley/Research studiesPress, 2009

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20EEE110	POWER QUALITY
Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To understand the theoretical concepts and standards of Power Quality (PQ), and methods to calculate and analyze voltage sag in distribution systems.
2. To have knowledge of Analysis of Voltage Sag
3. To understand PQ issues and sources of harmonics in Industrial systems and its mitigation

Course Outcomes: After completion of this course, students will be able to:
1. Acquire the knowledge of theoretical concepts and standards of Power Quality issues and its measurement
2. Acquire knowledge in identifying sources of harmonics
3. Acquire the knowledge to analyze voltage sag in distribution systems
4. Acquire the knowledge Harmonic Filtering Techniques
5. Acquire the knowledge in Solutions to power factor correction, Wiring and Grounding Problems

UNIT- I
Introduction to power quality: Overview of power quality phenomena, voltage quality, classification of power quality issues, Power quality measures and standards-THD-TIF-DIN-C-message weights. Flicker factor, transient phenomena-occurrence of power quality problems, Power acceptability curves- PQ Measuring Instruments. Standards and recommended practices

UNIT-II
Harmonics: Harmonic distortion and solutions, Voltage distortion Vs Current distortion, Sources of harmonics, Effect of harmonic distortion, Impact of capacitors, transformers and motors, harmonic sources from commercial and industrial loads, locating harmonic sources of power system.

UNIT-III
Voltage sag Analysis: Voltage sag Analysis, causes and sources of voltage sags, voltage flow chart, voltage sag magnitude and duration plots, fast assessment methods for voltage sags in distribution systems, effect of momentary voltage dips on the operation of Induction motor and Synchronous Motors.

UNIT-IV
Harmonic Filtering: Passive Harmonic Filtering, Three Phase Three-wire Shunt Active Filtering and their control using p-q theory and d-q modeling, Hybrid Filtering using Shunt Active Filters, Dynamic Voltage Restorer and its control, Power Quality Conditioner,

UNIT-V
PQ Consideration in Industrial Power Systems: Adjustable speed Drives and its applications, Reasons for grounding, typical wiring and grounding problems-solutions.
Power Factor Correction: Control Methods for Single Phase APFC, Three Phase APFC and Control Techniques

Text Books:
1. G.T. Heydt, "Electric power quality", McGraw-Hill Professional, 2007
2. Math H. Bollen, "Understanding Power Quality Problems", IEEE Press, 2000
3. C.Sankaran, 'Power Quality', CRC Press, 2001

Suggested Reading:
1. J. Arrillaga, "Power System Quality Assessment", John wiley, 2000
2. J. Arrillaga, B.C. Smith, N.R. Watson & A. R.Wood ,"Power system Harmonic Analysis", Wiley, 1997
3. Roger C.Dugan, Mark F.McGranaghan, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality', 3rd Edition,Tata McGraw-Hill, 2012.
4. R.Sastry Vedam, M.Sarma, "Power Quality- Var Compensation in Power Systems ", CRC Press, 2009

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20EEE114 **SMART GRIDS**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To Understand concept of smart grid and its advantages and the operation of smart devices such as PMU, IED etc.
2. To know smart metering techniques and wide area measurement techniques.
3. To understand the operation of micro grid and its components and the problems associated with integration of distributed generation & its solution through smart grid.

Course Outcomes: After completion of the course, students will be able to:
1. Appreciate the difference between smart grid & conventional grid.
2. Acquire knowledge of smart devices such as PMU, IED etc
3. Apply smart metering concepts to industrial and commercial installations.
4. Formulate solutions in the areas of smart substations, distributed generation and wide area measurements.
5. Acquire knowledge of micro grid and modern communication technologies

UNIT-I
Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Need of Smart Grid, Concept of Robust &Self-Healing Grid, Present development & International policies in Smart Grid

UNIT-II
Smart Devices-I: Real Time Prizing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home and Building Automation, Smart Substations, Substation Automation, Feeder Automation.

UNIT-III
Smart Devices-II: Geographic Information System (GIS),Intelligent Electronic Devices (IED) & their application for monitoring & protection, Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU).

UNIT-IV
Micro-grid: Need and applications of micro-grid, Formation of micro-grid, Issues of interconnection, Protection and control of micro-grid, Plastic and Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel-cells, micro-turbines, Captive power plants, Integration of renewable energy sources.

UNIT-V
Communication Systems: Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN), Bluetooth, ZigBee, GPS, Basics of CLOUD computing and Cyber Security for Smart Grid, Broadband over Power line (BPL). IP based protocols.

Text Books:
1. Ali Keyhani, Design of smart power grid renewable energy systems, Wiley IEEE, 2011.
2.Clark W. Gellings,The Smart Grid: Enabling Energy Efficiency and Demand Response, CRC Press.

Suggested Reading:
1. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, "Smart Grid: Technology and Applications", Wiley 2012.
2. Stuart Borlas'e, "Smart Grid:Infrastructure, Technology and solutions" CRC Press.
3. A.G.Phadke , "Synchronized Phasor Measurement and their Applications", Springer.

20EEE115 HIGH VOLTAGE ENGINEERING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To understand different high voltage measurements and the necessary instruments
2. To know how to measure high voltage AC/DC and impulse voltages and currents
3. To understand the planning, safety principles and layout of HV labs

Course Outcomes: After completion of this course, student will be able to:
1. Acquire knowledge about high voltage generation techniques
2. Acquaint with the different methods of generating high voltage AC/DC and impulse voltages and currents
3. Acquire the knowledge of measurement techniques for high voltage AC/DC and impulse voltages and currents
4. Acquire knowledge about planning and layout of HV labs
5. Attain methods of shielding, grounding and other safety precautions of HV labs

UNIT-I
Generation of High DC& AC voltages: Half and full wave rectifier circuits, Voltage doubler circuits, Voltage multiplier circuits: Cascaded rectifier circuit, Cockroft Walton voltage multiplier circuit, Electrostatic machines: Van de Graaff Generators, Electrostatic generators, Cascade transformers, Resonant transformers.

UNIT-II
Generation of Impulse voltages and currents: Impulse generator circuits, Multistage Impulse generator circuit, Generation of switching surges, Generation of impulse currents: Circuit for producing impulse current wave, Generation of high impulse currents, Generation of rectangular current pulses, Tripping and control of impulse generators.

UNIT-III
Measurement of High Voltage and Currents: Sphere gap, Factors affecting the spark over voltage, Uniform field spark gap, Rod gap, Electrostatic voltmeter, Generating voltmeter, Measurement of electric fields, Potential dividers (Resistive and Capacitive), Series impedance ammeters, Rogowski coils, Hall Effect generators, Digital techniques in HV measurements.

UNIT-IV
Planning and Layout of High Voltage Labs: Test facilities in HV labs, Classification of HV labs, Voltage and power ratings of test equipment, Layout of HV labs, Clearance, Shielding and Grounding of HV labs, Recent trends in HV engineering.

UNIT-V
High Voltage Safety Principles: Indian standards for HV clearances, Calibration of HV measuring instruments, Safety earthing, Safety in HV laboratory, Safety regulations for high voltage tests.

Text Book:

1. M.S.Naidu and V.Kamaraju, “High Voltage Engineering”, Tata McGraw Hill 2001.
2. C.L. Wadhwa, “High Voltage Engineering”, Wiley Eastern Ltd., New Delhi, 1994

Suggested Reading:

1. M. Khalifa, “High Voltage Engineering: Theory and Practise”, Dekker, 1990.
2. E.Kuffel, W.S.Zaengl and J.Kuffel, “High Voltage Engineering Fundamentals”, Newness Publication, 2000.

20EEE104 POWER SEMICONDUCTOR DEVICES AND MODELING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To understand the static and dynamic characteristics of current and voltage controlled power semiconductor devices
2. To enable the selection of devices for different power electronics applications
3. To understand the control, protection and firing circuits for different power devices.

Course Outcomes: After completion of this course, students will be able to:
1. Understand, the attributes of an ideal switch and its selection for a Specific Power electronic application.
2. Analyze the static and switching characteristics of different current controlled semiconductor devices
3. Analyze the static and switching characteristics of different voltage controlled semiconductor devices and also to differentiate various voltage controlled devices.
4. Design different firing and protection circuits for power semiconductor devices.
5. Select different heat sinks for power semiconductor devices.

UNIT-I
Power Switching Devices Overview: Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Device selection strategy – On-state and switching losses, EMI due to switching, Power diodes, Types, forward and reverse characteristics, switching characteristics, rating.

UNIT-II
Current Controlled Devices: BJT's, Construction, static characteristics, switching characteristics; Negative temperature coefficient and secondary breakdown; Power Darlington, Thyristors: Physical and electrical principle underlying operating mode, Two transistor analogy, concept of latching; Gate and switching characteristics; converter grade and inverter grade and other types; series and parallel operation; comparison of BJT and Thyristor, steady state and dynamic models of BJT & Thyristor.

UNIT-III
Voltage Controlled Devices: Power MOSFETs and IGBTs, Principle of voltage controlled devices, construction, types, static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs - Basics of GTO, MCT, RCT and IGCT, Comparison of all power devices.

UNIT-IV
Firing and Protecting Circuits: Necessity of isolation, Pulse transformer, Opto coupler, Gate drives circuit- SCR, MOSFET, IGBTs and base driving for power BJT.

Protection: Voltage protection by Selenium Diodes and Metal-Oxide Varistors, Current Protection, Fusing, Fault Current with AC and DC sources, Design of snubbers.

UNIT-V
Thermal Protection: Heat transfer, conduction, convection and radiation; Cooling, liquid cooling, vapour phase cooling; Guidance for hear sink selection, Thermal resistance and impedance, Electrical analogy of thermal components, heat sink types.

Text Books:
1. B.W Williams, Power Electronics Circuit Devices and Applications, John wiley & sons, 1987.
2. Rashid M.H., Power Electronics Circuits, Devices and Applications, PHI, Third Edition, New Delhi, 2004
3. Mohan, Undeland and Robins, Power Electronics Concepts, applications and Design, John Wiley and Sons, Singapore, 2000.

Suggested Reading:
1. MD Singh and K.B Khanchandani, Power Electronics, Tata McGraw Hill, 2001.
2. Joseph Vithayathil, Power Electronics: Principles and Applications, Delhi, Tata McGrawHill, 2010.

20EEE105 **ELECTRIC DRIVE SYSTEM**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To understand Basic electrical drives and their analysis.
2. To learn Design of controller for drives.
3. To understand vector control of electrical drives.

Course Outcomes: After completion of this course, students will be able to:
1. Model the Electric Drive System
2. Design modulation strategies of power electronics converters, for drives application
3. Design appropriate current/voltage regulators for electric drives
4. Select and implement the drives for Industrial Process
5. Implement various variable speed drives in Electrical Energy Conversion System

UNIT-I

Dynamics of Electric Drives: Fundamentals of torque equation. Speed torque convention and multi-quadrant operation, components of load torques. Classification of load torques steady state stability. Load equation, Speed control and drive classification. Close loop control of drives.

UNIT -II

DC Motor Drives: Modeling of DC machines. Steady state characteristics with armature and speed control. Phase controlled DC motor drives, chopper-controlled DC motor drives.

UNIT-III

Three Phase Induction Motor Drive: Dynamic modeling of induction machines. Small signal equations, control characteristics of induction machines, Phase-controlled induction machines, Stator voltage control, Static Slip recovery schemes, frequency control and vector control of induction motor drives.

UNIT-IV

Traction Motor: Review of characteristics of different types of DC & AC motors used for traction and their suitability. Starting and Braking methods of traction motors.

UNIT -V

Industrial Drives: Digital Control of Electric Drives. Stepper motor. Servo motor and their Applications.

Text Books:

1. G.K, Dubey, Power semi-conductor controlled Drives, Prentice Hall international, New Jersey, 1989.
2. R.Krishnan, Electric motor drives modelling, analysis and control, PHI-India-2009.
3. G.K.Dubey,"Fundamentals of electric Drives, Narosa Publishing House",2nd edition, 2011

Suggested Reading:

1. W. Leonhard, Control of Electrical drives, Springer, 3rd edition, 2001.
2. P.C. Krause, Analysis of Electric Machine, Wiley-IEEE press 3rd edition
3. K. Bose,Modern Power Electronics and AC Drives, Prentice Hall publication, 1st edition, 2001.

20EEE106 **HVDC TRANSMISSION**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To understand state of the art of HVDC technology and converter operation for two and multi- terminal DC systems.
2. To acquire knowledge about methods of HVDC converter control.
3. To understand the concept of AC-DC system interactions and protection scheme in HVDC system.

Course Outcomes: After completion of the course, students will be able to:
1. Explain state of the art HVDC technology.
2. Demonstrate the knowledge of HVDC converter operation and methods of control.
3. Demonstrate the knowledge of HVDC converter characteristics and control methods.
4. Demonstrate the knowledge of the protection methods and AC-DC system interactions.
5. Demonstrate the knowledge of multi-terminal DC systems.

UNIT-I
HVDC Power Transmission Technology: Development of HVDC Technology, DC versus AC Transmission, Selection of converter configuration.

UNIT-II
HVDC Converters: Rectifier and Inverter operation with and without overlap, comparison between rectifier and inverter mode of operation, Digital Simulation of converters, Control of HVDC converters and Systems.

UNIT-III
Converter Control: Individual phase control, Equidistant firing controls, higher level controls. Characteristics and non-characteristics harmonics filter design. Fault development and protection.

UNIT-IV
HVDC Systems: Interaction between AC-DC power systems, over voltages on AC/DC side, multi-terminal HVDC systems, control of MTDC systems.

UNIT-V
Modeling of HVDC Systems: Per unit system, Representation for power flow solution, representation for stability studies.

Text Books:
1. S.Kamakshaiah, V.Kamaraju,' HVDC Transmission', Tata McGraw-Hill Education Pvt. Ltd., 2011.
2. K. R. Padiyar, "HVDC Power Transmission Systems", Wiley Eastern Ltd., 1990.

Suggested Reading:
1. E. W. Kimbark, "Direct Current Transmission", Vol. I, Wiley Inderscience, 1971.
2. Erich Uhlmann, "Power Transmission by Direct Current", B.S. Publications, 2004.
3. Arrillaga, "High Voltage Direct Transmission", Peter Peregrinus Ltd. London, 1983.

20EEE108 **Artificial Intelligence Techniques for Power Systems**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To understand concepts of Artificial Neural Networks, Fuzzy logic and Meta-heuristic Techniques
2. To acquire the knowledge of optimization techniques and their hybridization with ANN and Fuzzy
3. To learn the intelligent approaches for the Power systems planning and operation

Course Outcomes: After completion of the subject, students will be able to:
1. Understand the various Artificial Intelligent and Meta-heuristic Techniques
2. Classify the techniques according to their method of approach
3. Select the suitable technique for the given power system problem
4. Implement suitable Intelligent technique for the given power system problem
5. Execute any power system planning and operation using Artificial Intelligent Techniques

UNIT-I
Artificial Neural Network (ANN): Biological foundations to intelligent Systems, Difference between Artificial Neuron and Biological Neuron, Activation functions, Basic Models of ANN, Hebb Rule, Training/Learning of NN, Supervised Learning Algorithms: Perceptron, Adaline, Back propagation algorithm, RBF NN, Associative Memory Networks: BAM NN, Hopfield NN, Unsupervised Learning Networks: LVQ algorithm, ART Network.

UNIT-II
Fuzzy Logic: Introduction to Fuzzy logic, Fuzzy sets, Fuzzy relations, Membership Functions, Defuzzification methods, Fuzzy reasoning, Fuzzy Inference System (FIS), Fuzzy Decision Making

UNIT-III
Meta-heuristic Techniques: Introduction, Genetic Algorithm, Particle Swarm Optimization, Differential Evolution, Simulated Annealing, Ant Colony Optimization, Honey Bee Algorithm, Harmony Search algorithm, Teaching-Learning-based algorithm, JAYA Algorithm.

UNIT-IV:
Hybrid System: characteristics, classification, ANFIS, Genetic-Neuro-Hybrid system: Properties, GA-based BPN, Advantages, Genetic-Fuzzy Hybrid Systems: Genetic-Fuzzy Rule based systems

UNIT-V
Applications:
Applications Artificial Intelligence Techniques in power systems for solving Load flow studies, Fault identification and classification, Load frequency Control, Excitation control, Economic Load Dispatch, Optimal Power Flow.

Text Books:
1. S.N.Sivanandam, S.N.Deepa, 'Principles of soft computing techniques', Wiley publications, 2007.
2. Xin-She Yang, "Nature-inspired optimization algorithms", Elsevier Inc., 2008.
3. S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms"- PHI, New Delhi, 2010.

Suggested Reading:
1. Haykin, Simon. *Neural networks: a comprehensive foundation*. Prentice-Hall, Inc., 2007.
2. Ross, Timothy J. *Fuzzy logic with engineering applications*. Vol. 2. New York: wiley, 2004.
3. Goldberg, David E. *Genetic algorithms*. Pearson Education India, 2006.
4. Clerc, Maurice. *Particle swarm optimization*. Vol. 93. John Wiley & Sons, 2010.

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20EEE111 **FACTS AND CUSTOM POWER DEVICES**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To introduce the concepts of reactive power compensation which can be used for interconnected power transmission and distribution systems
2. To study the principles of operation and control of shunt, series and combined FACTS controllers
3. To study the various types of power quality problems in distribution systems and to know about the filters

Course Outcomes: After completion of the course, students will be able to:
1. Distinguish the performance of Transmission line with and without FACTS Devices
2. Compare the SVC and STATCOM
3. Understand the operation and control of various Static Series Compensators
4. Understand the operation and control of Unified Power Flow Controller
5. Distinguish various power quality issues and how are they mitigated by various FACTS Devices

UNIT-I
Reactive Power Flow Control in Power Systems: Power flow control, Constraints of maximum transmission line loading, Benefits of FACTS Transmission line compensation, Uncompensated line, Shunt compensation, Series compensation, Phase angle control, Reactive power compensation, Shunt and Series compensation principles, Reactive compensation at transmission and distribution level.

UNIT-II
Static Shunt Compensation: Static versus passive VAR compensator, Static shunt compensators, SVC and STATCOM, Operation and control of TSC, TCR and STATCOM Compensator control, Comparison between SVC and STATCOM.

UNIT III
Static Series Compensation: TSSC, SSSC -Static voltage and phase angle regulators, TCVR and TCPAR Operation and Control, Applications, Static series compensation, GCSC, TSSC, TCSC and Static synchronous series compensators and their Control.

UNIT IV
Combined Power Flow Controller: Circuit Arrangement, Operation and control of UPFC, Basic Principle of P and Q control, Independent real and reactive power flow control- Applications, Introduction to interline power flow controller (IPFC)

UNIT V
Power Quality Problems in Distribution Systems: harmonics, Loads that create harmonics, harmonic propagation, series and parallel resonances, mitigation of harmonics, passive filters, active filter, shunt, series, hybrid filters and their control.
Voltage swells, sags, flicker, unbalance and mitigation of these problems by unified power quality conditioner (UPQC), IEEE standards on power quality.

Text Books:
1. K R Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International Publishers, 2007.
2. N.G. Hingorani, L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.

Suggested Reading:

1. X P Zhang, C Rehtanz, B Pal, "Flexible AC Transmission Systems- Modelling and Control", Springer Verlag, Berlin 2006.
2. K.S.Sureshkumar, S.Ashok , "FACTS Controllers & Applications", E-book edition, Nalanda Digital Library, NIT Calicut, 2003.
3. G. T. Heydt, "Power Quality", McGraw-Hill Professional, 2007.
4. T. J. E. Miller, "Static Reactive Power Compensation", John Wiley and Sons, New York, 1982

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20EEE112 SWITCH MODE & RESONANT CONVERTERS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To apply the basic concepts of power electronics for designing converters.
2. To understand various types of SMPS design and its control methods
3. To know the stability analysis for the converters using Bode plots.

Course Outcomes: After completion of this course, students will be able to:
1. Identify different power electronic circuits for designing converters.
2. Design various types of SMPS for electrical applications.
3. Design control methods for SMPS
4. Analyze the stability using Bode plots for the converters.
5. Select different components used in SMPS hardware.

UNIT-I
Basic Converter Circuits: Buck Regulator, Boost Regulator, Buck Boost Regulator, Cuk Converters, Resonant Converters, Choice of Switching Frequency-Design Aspects

UNIT-1I
Isolated SMPS: Fly back Converters, Forward Converters, Half Bridge and Full Bridge Converters, Push Pull Converters and SMPS with multiple outputs, Choice of Switching Frequency-Design Aspects

UNIT-III
Control Aspects: PWM Controllers, isolation in feedback loop, Power Supplies with Multiple outputs, Stability analysis using Bode Diagrams.

UNIT-IV
Design Considerations: Selection of Output Filter Capacitor, Selection of Energy Storage Inductor, Design of High Frequency Inductor and High Frequency Transformer, Selection of Switches, Snubber Circuit Design, Design of Driver Circuits- Power MOSFETS.

UNIT-V
Electromagnet Interference (EMI): EMI Filter Components, Conducted EMI suppression, Radiated EMI suppression, Measurement. Protection: Over current over voltage protection, inrush current protection

Text Books:
1. Mohan N. Undeland. T & Robbins W, Power Electronics Converters, Application and Design, John Wiley, 3rd edition, 2002.
2.. M.H. Rashid, Power Electronics. Prentice-Hall of India.
3. Switched Mode Power Supplies, Design and Construction, H. W. Whittington, B. W. Flynnand D. E. MacPherson, Universities Press, 2009 Edition.

Suggested Reading:
1.Umanand L., Bhat S.R., Design of magnetic components for switched Mode Power Converters. , Wiley Eastern Ltd.,1992
2.Course Material on Switched Mode Power Conversion, V.Ramanarayanan.

20EEE113 ENERGY AUDITING AND MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To understand the need for energy auditing
2. To understand of various loads involved based on power consumption for auditing
3. To know about different audit instruments used in practice

Course Outcomes: After completion of this course, students will be able to:
1. Acquire the background required for engineers to meet the role of energy managers
2. Gain the skills and techniques required to implement energy management
3. Demonstrate energy conservation aspects
4. Apply the energy conservation techniques to industrial loads
5. Perform basic energy audit in an organization

UNIT-I

Energy Auditing: Types and objectives, audit instruments. ECO assessment and Economic methods specific energy analysis, Minimum energy paths, consumption models, Case study

UNIT-II

Energy Efficient Motors: Electric motors, Energy efficient controls and starting efficiency, Motor Efficiency and Load Analysis Energy efficient / high efficient Motors, Case study.

Load Matching and selection of motors, Variable speed drives, Pumps and Fans, Efficient Control strategies, optimal selection and sizing.

UNIT-III

Energy Conservation Aspects: Transformer Loading/Efficiency analysis, Feeder/cable loss evaluation, Reactive Power management, Capacitor Sizing, Degree of Compensation, Capacitor losses, Location, Placement and Maintenance, Peak Demand controls, Methodologies.

UNIT-IV

Industrial Loads: Types of Industrial loads, Optimal Load scheduling-case study, Lighting, Energy efficient light sources, Energy conservation in Lighting Schemes, Electronic ballast, Power quality issues, Luminaries, Case study, Cogeneration, Types and Schemes, Optimal operation of cogeneration plants.

UNIT-V

E.C. Measures: Electric water heating, Geysers, Solar Water Heaters. Power Consumption in Compressors, Energy conservation measures, software, EMS

Text Books:
1. Umesh Rathore: Energy Management,S.K.Kataria &sons second edition
2. Anthony J. Pansini, Kenneth D. Smalling, Guide to Electric Load Management. PennwellPub;(1998)
3. Howard E. Jordan, Energy-Efficient Electric Motors and Their Applications., Plenum Pub Corp; 2ndedition, 1994

Suggested Reading:
1. Tanuj Kumar Bishat: SCADA and Energy Management system ;S.K.Kataria &sons, second edition
2. Giovanni Petrecca, Industrial Energy Management: Principles and Applications, The Kluwer international series -207, 1999

20EEE116 **ELECTRIC AND HYBRID VEHICLES**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course objectives:
1. To know the conventional vehicles and their disadvantages.
2. To understand the concept hybrid electric vehicles.
3. To explore the different energy management strategies.

Course Outcomes: After completion of this course, students will be able to:
1. Be familiar to the models of describing hybrid vehicles and their performance.
2. Model the electric vehicles with different acceleration and range.
3. Design various configuration and control strategies for electric drives.
4. Analyze the different possible ways of energy storage.
5. Design of a Hybrid Electric Vehicle, Battery Electric Vehicle.

UNIT-I
Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance, EV System – EV Advantages – Vehicle Mechanics – Performance of EVs.

UNIT-II
Hybrid Electric Vehicles: Introduction, History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Electric Vehicle Modeling– Consideration of Rolling Resistance – Transmission Efficiency – Consideration of Vehicle Mass – Tractive Effort – Modeling Vehicle Acceleration – Modeling Electric Vehicle Range.

UNIT-III
Electric Trains: Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive train topologies, fuel efficiency analysis, Basic concept of electric traction, Electric Propulsion unit, Introduction to electric components used in hybrid and electric vehicles, characteristics and regenerative braking, drive system efficiency.

UNIT-IV
Energy Storage Systems: Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE)

UNIT-V
Energy Management Strategies: Energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

Text Books:
1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications withPractical Perspectives", John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies",Springer, 2015.

Suggested Readings:
1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

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Open Electives

20CSO 101 **BUSINESS ANALYTICS**

Instruction	3 Hours per week
Duration of End examination	3 Hours
Semester end examinations	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The main objectives of this course are to:
1. Understanding the basic concepts of business analytics and applications
2. Study various business analytics methods including predictive, prescriptive and prescriptive analytics
3. Prepare the students to model business data using various data mining, decision making methods

Course Outcomes: After completion of the course, students will be able:
1. To understand the basic concepts of business analytics
2. Identify the application of business analytics and use tools to analyze business data
3. Become familiar with various metrics, measures used in business analytics
4. Illustrate various descriptive, predictive and prescriptive methods and techniques
5. Model the business data using various business analytical methods and techniques

Unit-I
Introduction to Business Analytics: Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

Unit-II
Descriptive Analytics: Introduction, data types and scales, types of measurement scales, population and samples, measures of central tendency, percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization

Unit-III
Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil's coefficient

Unit-IV
Decision Trees: CHAID, Classification and Regression tree, splitting criteria, Ensemble and method and random forest. **Clustering**: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, **Prescriptive Analytics**- Linear Programming (LP) and LP model building,

Unit-V
Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process, cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox

Text Books:

1. U Dinesh Kumar, "Data Analytics", Wiley Publications, 1st Edition, 2017
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications with SAS", Associate Publishers, 2015

Suggested Reading:

1. S. Christian Albright, Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", 5th Edition, Cengage, 2015

Web Resources:
1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview
2. https://nptel.ac.in/courses/110105089/

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20MEO 101 **INDUSTRIAL SAFETY**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The students will be able to understand
1. Causes for industrial accidents and preventive steps to be taken.
2. Fundamental concepts of Maintenance Engineering. About wear and corrosion along with preventive steps to be taken. The basic concepts and importance of fault tracing.
3. The steps involved in carrying out periodic and preventive maintenance of various equipments used in industry

Course Outcomes: At the end of the course the students will be able to:
1. Identify the causes for industrial accidents and suggest preventive measures.
2. Identify the basic tools and requirements of different maintenance procedures.
3. Apply different techniques to reduce and prevent Wear and corrosion in Industry.
4. Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
5. Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc

UNIT - I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT – II

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT – III

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication, Definition of corrosion, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.

UNIT–IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, any one machine tool, Pump, Air compressor, Internal combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.

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UNIT – V

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. H. P. Garg, "Maintenance Engineering", S. Chand and Company
2. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication

Suggested Readings:

1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services.
2. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London

If we have built castles in the air, our work need not be lost; that is where they should be. Now lay the foundation under them. But a fool is one who, having no goal, redoubles his efforts.

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20MEO 102 INTRODUCTION TO OPTIMISATION TECHNIQUES

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:

1. Students will come to know the formulation of LPP models
2. Students will understand the Algorithms of Graphical and Simplex Methods. Students will understand the Transportation and Assignment techniques. Students will come to know the procedure of Project Management along with CPM and PERT techniques
3. Students will understand the concepts of sequencing

Course Outcomes: At the end of the course, the students were able to:

1. Formulate a managerial decision problem into a mathematical model;
2. Apply transportation problems in manufacturing industries;
3. Build and solve assignment models
4. Apply project management techniques like CPM and PERT to plan and execute project successfully
5. Apply sequencing concepts in industry applications

UNIT-I

Introduction: Definition and Scope of Operations Research.

Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method

UNIT-II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Unbalanced Transportation problem, Degeneracy in Transportation,

UNIT-III

Assignment Techniques: Introduction, Hungarian technique of Assignment techniques, unbalanced problems, problems with restrictions, Maximization in Assignment problems

UNIT-IV

Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of critical path, duration of the project

UNIT-V

Sequencing Models: Introduction, General assumptions, processing 'n' jobs through two machines, processing 'n' jobs through three machines.

Text Books:

1. Hamdy, A. Taha, "Operations Research-An Introduction", Prentice Hall of India Pvt. Ltd., 6/e, 1997.
2. S.D. Sharma, "Operations Research", Kedarnath, Ramnath & Co., Meerut, 2009.
3. V.K. Kapoor, "Operations Research", S. Chand Publishers, New Delhi, 2004.

Suggested Reading:

1. Harvey M. Wagner, "Principles of Operations Research", Second Edition, Prentice Hall of India Ltd., 1980.
2. R. Paneer Selvam, "Operations Research", Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2008
3. Nita H. Shah, Ravi M. Gor, Hardik Soni, "Operations Research", PHI Learning Private Limited, 2013

20MEO 103 **COMPOSITE MATERIALS**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: To make the students to learn the

1. Composite materials and their constituents. Classification of the reinforcements and evaluate the behavior of composites.
2. Fabrication methods of metal matrix composites. Manufacturing of Polymer matrix composites.
3. Failure mechanisms in composite materials.

Course Outcomes: At the end of the course, student will be able to

1. Classify and characterize the composite materials.
2. Describe types of reinforcements and their properties.
3. Understand different fabrication methods of metal matrix composites.
4. Understand different fabrication methods of polymer matrix composites.
5. Decide the failure of composite materials.

UNIT - I

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepegs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V

Strength: Lamina Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength;

Text Books:

1. R.W.Cahn – VCH , "Material Science and Technology", (Vol 13) Composites , West Germany.
2. WD Callister, Jr., Adapted by R. Balasubramaniam , "Materials Science and Engineering, an introduction"., John Wiley & Sons, NY, Indian edition, 2007.

Suggested Readings:

1. Ed-Lubin, "Hand Book of Composite Materials"
2. K.K.Chawla, "Composite Materials".
3. Deborah D.L. Chung, "Composite Materials Science and Applications"
4. Daniel Gay, Suong V. Hoa, and Stephen W. Tsai, "Composite Materials Design and Applications"

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20CEO 101 COST MANAGEMENT OF ENGINEERING PROJECTS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:

1. To enable the students to understand the concepts of Project management. To provide knowledge on concepts of Project Planning and scheduling.
2. To create an awareness on Project Monitoring and Cost Analysis. To provide adequate knowledge to the students on Recourse Management Costing-Variance Analysis
3. To train the students with the concepts of Budgetary Control for cost management and to provide basic platform on Quantitative techniques for cost management.

Course Outcomes: At the end of course students will able to

1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
2. Determine the critical path of a typical project using CPM and PERT techniques.
3. Prepare a work break down plan and perform linear scheduling using various methods.
4. Solve problems of resource scheduling and leveling using network diagrams.
5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.

UNIT- I:
Project Management: Introduction to project managements, stakeholders, roles, responsibilities and functional relationships. Principles of project management, objectives and project management system. Project team, organization, roles, responsibilities. Concepts of project planning, monitoring, staffing, scheduling and controlling.

UNIT- II:
Project Planning and Scheduling: Introduction for project planning, defining activities and their interdependency, time and resource estimation. Work break down structure. Linear scheduling methods-bar charts, Line of Balance (LOB), their limitations. Principles, definitions of network-based scheduling methods: CPM, PERT. Network representation, network analysis-forward and backward passes.

UNIT- III:
Project Monitoring and Cost Analysis: introduction-Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making, Time cost tradeoff-Crashing project schedules, its impact on time on time, cost. Project direct and indirect costs.

UNIT- IV:
Resources Management and Costing-Variance Analysis: Planning, Enterprise Resource Planning, Resource scheduling and levelling. Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis
Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement

UNIT- V:
Budgetary Control:: Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.
Quantitative techniques for cost management: Linear Programming, PERT/CPM, Transportation Assignment problems, Simulation, Learning Curve Theory.

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Text Books:

1. Charles T Horngren "*Cost Accounting A Managerial Emphasis*", Pearson Education; 14 edition (2012),
2. Charles T. Horngren and George Foster, "*Advanced Management Accounting*" Prentice-Hall; 6th Revised edition (1 February 1987)
3. Robert S Kaplan Anthony A. Atkinson, "*Management & Cost Accounting*" , Pearson; 2 edition (18 October 1996)

Suggested Readings:

1. K. K Chitkara, "*Construction Project Management: Planning, scheduling and controlling*", Tata McGraw-Hill Education. (2004).
2. Kumar Neeraj Jha "*Construction Project Management Theory and Practice*", Pearson Education India; 2 edition (2015)

Running away does not help us with our problems; unless we are overweight! Running away from our problems is a race we will never win. You can't run away from trouble. There is no place that far.

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With effect from the academic year 2020-21

20EEO 101 **WASTE TO ENERGY**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives:
1. To know the various forms of waste
2. To understand the processes of Biomass Pyrolysis.
3. To learn the technique of Biomass Combustion.

Course Outcomes: After completion of this course, students will be able to:
1. Understand the concept of conservation of waste
2. Identify the different forms of wastage
3. Chose the best way for conservation to produce energy from waste
4. Explore the ways and means of combustion of biomass
5. Develop a healthy environment for the mankind

UNIT-I
Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers– Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV
Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V
Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Text Books:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Suggested Readings:

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
2. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Audit Courses

20 EG A 101 **ENGLISH FOR RESEARCH PAPER WRITING**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks

Course Objectives:
1. To understand the nuances of language and vocabulary in writing a Research Paper.
2. To develop the content, structure and format of writing a research paper.
3. To enable the students to produce original research papers without plagiarism.

Course Outcomes: After successful completion of the course, the students will be able to:
1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. To review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

Unit 1
Academic Writing: Meaning & Definition of a research paper– Purpose of a research paper – Scope –Benefits-Limitations – outcomes.

Unit II
Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

Unit III
Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

Unit IV
Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading.

Unit V
Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits

Textbook:
1. C. R Kothari, Gaurav, Garg, **Research Methodology Methods and Techniques,** New Age International Publishers. 4th Edition.

Suggested Reading:
1. Day R (2006) **How to Write and Publish a Scientific Paper,** Cambridge University Press
2. **MLA Hand book for writers of Research Papers**, East West Press Pvt. Ltd, New Delhi, 7th Edition.
3. Lauri Rozakis, Schaum's, **Quick Guide to Writing Great Research Papers**, Tata McGraw Hills Pvt. Ltd, New Delhi.

Online Resources:
NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

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20EGA 102 **INDIAN CONSTITUTION AND FUNDAMENTAL RIGHTS**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks

Course Objectives: The course will introduce the students to:
1. The history of Indian Constitution and its role in the Indian democracy.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement. to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: After successful completion of the course he students will be able to:
1. Understand the making of the Indian Constitution and its features.
2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
3. Have an insight into various Organs of Governance - composition and functions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
5. Understand Electoral Process, special provisions.

ÜNIT I

History of making of the Indian constitutions - History, Drafting Committee (Composition & Working).
Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-II

Contours of Constitutional Rights and Duties - Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III

Organs of Governance- Parliament: Composition, Qualifications, Powers and Functions
Union executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT-IV

Local Administration - District's Administration head: Role and importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRI: Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: positions and role.
Block level: Organizational Hierarchy(Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT-V

Election commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and functioning. Institute and Bodies for the welfare of SC / ST / OBC and women

Text Books:

1. **The Constitution of India**, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, **Framing of Indian Constitution**, 1st Edition, 2015.
3. M. P. Jain, **Indian Constitution Law**, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, **Introduction to the Constitution of India**, Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

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20EGA 103 **STRESS MANAGEMENT BY YOGA**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks

Course Objectives: The Course will introduce the students to:
1. Creating awareness about different types of stress and the role of yoga in the management of stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by yoga practice.

Course Outcomes: After successful completion of the course, the students will be able to :
1. To understand yoga and its benefits.
2. Enhance Physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas
5. Improve work performance and efficiency.

Unit I
Meaning and definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.

Unit II
Meaning and definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

Unit III
Concept of Stress according to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress.

Unit IV
Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

Unit V
Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama – Kapalabhati**-**Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation Techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Text Books:
1. "**Yogic Asanas for Group Training - Part-I**": Janardhan Swami Yogabhyasi Mandal, Nagpur.
2. "**Rajayoga or Conquering the Internal Nature**"by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.
3. Nagendra H.R nad Nagaratna R, **Yoga Perspective in Stress Management**, Bangalore, Swami Vivekananda Yoga Prakashan

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

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20EGA 104 **PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks

Course Objectives: The course will introduce the students to :

1. To learn to achieve the highest goal happily.
2. To become a person with stable mind, pleasing personality and determination.
3. To awaken wisdom among themselves.

Course Outcomes: After successful completion of the course the students will be able to:

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. To practice emotional self regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

UNIT-I

Neetisatakam – Holistic development of personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT-II

Neetisatakam – Holistic development of personality (cont'd) - Verses 52, 53, 59 (dont's) - Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT-III

Introduction to Bhagavadgeetha for Personality Development - Shrimad Bhagawad Geeta: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 – Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT-IV

Statements of basic knowledge - Shrimad BhagawadGeeta: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

UNIT-V

Role of Bahgavadgeeta in the present scenario - Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Text Books:

1. "**Srimad Bhagavad Gita"** by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari's **Three Satakam** (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

Online Courses:

1. NTPEL: http://nptel.ac.in/downloads/109104115/

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20ECA 101 **VALUE EDUCATION**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks

Course Objectives:
1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Course outcomes: After completion of the Course, Students will be able to:
1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT I: Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behavior, standards and principles based on religion, culture and tradition.

UNIT II: Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT III: Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT IV: Values in Holy Books: Self-management and Good health; **and internal & external Cleanliness,** Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT V:Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasicgunas.

Text Books:

1. Chakroborty, S.K. “Values & Ethics for organizations Theory and practice”, Oxford University Press, New Delhi, 1998.
2. Jaya DayalGoyandaka, “Srimad Bhagavad Gita”, withSanskrit Text, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.

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20CEA 101 DISASTER MITIGATION AND MANAGEMENT

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks

Course Objectives: To enable the student

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters

2. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.

3. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course Outcomes: At the end of the course the student

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels

2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan

3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management

4. To understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same

5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

UNIT- I:
Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT- II:
Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT- III:
Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

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UNIT- IV:
Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT- V:
Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni*," Disaster Risk Reduction in South Asia*", Prentice Hall, 2003.
2. B. K. Singh,*" Handbook of Disaster Management*: *techniques & Guidelines*", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs". *Government of India, "National disaster management plan, Part I and II",*
2. K. K. Ghosh," *Disaster Management",* APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

All the problems in the life are because of only one reason; We forget what is to be remembered, we often remember what is to be forgotten!

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20IT A101 **PEDAGOGY STUDIES**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks

Course Objectives:
1. To present the basic concepts of design and policies of pedagogy studies. To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
2. To familiarize various theories of learning and their connection to teaching practice.
3. To create awareness about the practices followed by DFID, other agencies and other researchers. To provide understanding of critical evidence gaps that guides the professional development.

Course Outcomes: Upon completing this course, students will be able to:
1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

UNIT-I
Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT-II
Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT-III
Evidence on the Effectiveness of Pedagogical Practices: Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and pedagogic strategies.

UNIT-IV
Professional Development: alignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V
Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment – Dissemination and research impact.

Text Books:

1. Ackers J, Hardman F, “Classroom Interaction in Kenyan Primary Schools, Compare”, 31 (2): 245 – 261, 2001.
2. Agarwal M, “Curricular Reform in Schools: The importance of evaluation”, Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.

Suggested Reading:

1. Akyeampong K, “Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)”, Country Report 1.London: DFID, 2003.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, “Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?, International Journal Educational Development, 33 (3): 272- 282, 2013.
3. Alexander R J, “Culture and Pedagogy: International Comparisons in Primary Education”, Oxford and Boston: Blackwell, 2001.
4. Chavan M, “Read India: A mass scale, rapid, ‘learning to read’ campaign”, 2003.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview
2. www.pratham.org/images/resources%20working%20paper%202.pdf.

Keep acquaintance with all, friendship with some, but intimacy with only few.
It is hard to find a friend who is highly intelligent, handsome, wise and sweet!
So don’t lose ME! My friend has the best friend!

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20EEA101 SANSKRIT FOR TECHNICAL KNOWLEDGE

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks

Course Objectives:
1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects
3. To explore the huge knowledge from ancient literature

Course Outcomes: After completion of this course, students will be able to:
1. Develop passion towards Sanskrit language
2. Decipher the latent engineering principles from Sanskrit literature
3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress
5. Explore the avenue for research in engineering with aid of Sanskrit

UNIT-I
Introduction to Sanskrit language: Sanskrit Alphabets-vowels-consonants- significance of Amarakosa-parts of speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive voice-Past/Present/Future Tense-syntax-Simple Sentences (elementary treatment only)

UNIT-II
Role of Sanskrit in Basic sciences: Brahmagupthas lemmas (second degree indeterminate equations), sum of squares of n-terms of AP- sulba_sutram or baudhayana theorem (origination of pythogorous theorem)-value of pie-Madhava's sine and cosine theory (origination of Taylor's series).
The measurement system-time-mass-length-temp, Matter elasticity-optics-speed of light (origination of michealson and morley theory).

UNIT-III
Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering): Building construction-soil testing-mortar-town planning-Machine definition-crucible-furnace-air blower- Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth-Pingala chandasutram (origination of digital logic system)

UNIT-IV
Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languages-computer command words and the vedic command words-analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V
Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants-plants, the living-plants have senses-classification of living creatures- Chemical laboratory location and layout-equipment-distillation vessel-kosthi yanthram

Text Books:
1. M Krishnamachariar, History of Classical Sanskrit Literature, TTD Press, 1937.
2. Motilal Banarsidass Publishers, ISBN-13: 978-8120801783, 2015
3. Kpail Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
4. Pride of India, Samskrita Bharti Publisher, ISBN: 81-87276-27-4, 2007
5. Shri Rama Verma, Vedas the source of ultimate science, Nag publishers, ISBN: 81-7081-618-1, 2005

Suggested Reading:

1. The Wonder that is Sanskrit, AuroPublications, ISBN: 978-8170601821, 2017
2. Science in Sanskrit, Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. A Treasury of Indian Wisdom: An Anthology of Spiritual Learn, ISBN: 978-0143426158, 2016.

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Industrial Project / Internship

Guide lines:

To develop advanced knowledge and specific skills required for industrial development, CBIT is implementing the AICTE internship policy guidelines for ME/MTech students from the academic year 2020-21 onwards. Students may choose Industrial problem as Dissertation topic. The proposed Credit Framework for the same is as follows:

S. No	Schedule	Activities	Duration	Credits
1	Semester - III	Industrial Project /Dissertation Phase 1	20 weeks	10
2	Semester - IV	Industrial Project/Dissertation Phase 2	32 weeks	16

Guidelines:

- ✓ The student should submit a synopsis of the proposed work to be done during the internship Programme/Industrial Project/Dissertation/Industrial Dissertation which is examined or evaluated by the departmental Project Review Committee to ensure that the proposed work is equivalent to ME/MTech dissertation work. This synopsis should be submitted to the department before the candidate is relieved.
- ✓ Student has to submit the information about the commencement of internship to the HOD before the registration of the courses in that semester (i.e III/IV).
- ✓ Two supervisors will monitor the internship/ Industry project work, one from the department and another from industry.
- ✓ Industry/Educational Organization must submit the month-wise attendance of the students to the department.
- ✓ Student should regularly present his/her project progress report to their respective internal supervisor(s)
- ✓ The final project presentation is evaluated on the basis of the recommendation given by external supervisor, and further can be evaluated by the institute supervisor.
- ✓ If the internship project is not found to be of high quality, then the student will have to reappear in the next semester for their ME/MTech dissertation work.
- ✓ The student is required to publish internship work in conferences and journals with due permission/consent from the organization/Industry where he/she has undergone the internship.
- ✓ If the student feels that the internship work is not of high quality/not related to that field of interest, then the student should submit the application to the department HoD within THREE weeks and can re-join the institute.
- ✓ Industry/Institute should allow producing results obtained during project/internship period in the project report. The written certificate to this effect from the industry/institute is mandatory before consideration of the proposed project/internship.

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with effect from the Academic Year 2020-21

20MT C05

CALCULUS
(Common to ECE, EEE, MECH, CHEM, CIVIL)

Instruction	3 L+1T /2P Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives:

1. To explain the solutions of system of linear equations by Matrix Methods.
2. To discuss mean value theorems.
3. To explain the Partial Derivatives and the extreme values of functions of two variables.
4. To discuss the convergence and divergence of the series.
5. To explain the expansion of functions in sine and cosine series.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the Matrix Methods to solve system of linear equations.
2. Analyse the geometrical interpretation of Mean value theorems.
3. Determine the extreme values of functions of two variables.
4. Examine the convergence and divergence of infinite Series.
5. Calculate the Euler's coefficients for Fourier series of a function.

UNIT-I

Matrices: Rank of a matrix, Echelon form, consistency of linear system of equations, Linear dependence and independence of vectors. Eigen values, Eigenvectors, Properties of Eigen values & Eigen vectors, Cayley-Hamilton theorem, Quadratic form, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-II

Calculus: Rolle's Theorem, Lagrange's Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, Radius of curvature, Centre of curvature, Evolute and Involute.

UNIT-III

Multivariable Calculus (Differentiation): Functions of two variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions , Change of variables, Jacobians, Taylor's theorem for functions of two variables, Maxima and minima of functions of two variables.

UNIT-IV

Sequences and Series: Convergence of sequence and series. Tests for convergence of series: Comparison test, limit comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, alternating series, Leibnitz's series, absolute and conditional convergence.

UNIT-V

Fourier series: Periodic functions, Euler' formulae**,** Conditions for a Fourier expansion, functions having points of discontinuity, change of interval, even and odd functions, half range sine series, half range cosine series, and its applications in practical Harmonic analysis.

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. B.V.Ramana., Higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw- Hill, New Delhi, 2008.
2. R.K.Jain, S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. David.Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

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20CY C01

CHEMISTRY
(Common to all branches)

Instruction:	3Hours per Week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	3

Course Objectives

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

Course Outcomes

At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

UNIT-I Atomic and molecular structure and Chemical Kinetics:

Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method.Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2 , He_2^+ ,N_2 , O_2 , O_2^- , CO, NO). Pi- molecular orbitals of benzene and its aromaticity.

Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction-Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity).Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, – Reference electrodes (NHE, SCE)-electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations.Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.
Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages.
Construction, working & applications of methanol-oxygen fuel cell.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism - Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid) & Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.

Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)

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Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)
Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides)
Cyclization (Diels - Alder reaction)

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process),ion exchange method and Reverse Osmosis.Specifications of potable water & industrial water.Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V Engineering Materials and Drugs:
Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber).Conducting polymers- Definition, classification and applications.
Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography.
Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation-Sol-gel method.Carbon nanotubes and their applications.Characterisation of nanomaterials by SEM and TEM (only Principle).
Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition(2019).
4. A Textbook of Polymer Science and Technology, Shashi Chawla,Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Readings:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

20CE C01

ENGINEERING MECHANICS – I

Instruction:	3 L Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	3

Course Outcomes: At the end of the course the student will be able to

1. Calculate the components and resultant of coplanar forces system.
2. Understand free body diagram and apply equilibrium equations to solve for unknown forces.
3. Apply concepts of friction for solving engineering problems.
4. Analyse simple trusses for forces in various members of a truss.
5. Determine centroid for elementary, composite figures and bodies.

UNIT- I:

Resolution and Resultant of Force System: Basic concepts of a force system. Components of forces in a plane. Resultant of coplanar concurrent force system. Moment of a force, couple and their applications. Resultant of coplanar non-concurrent force system.

UNIT - II:

Equilibrium of Force System: Free body diagram, equations of equilibrium. Lami's theorem, equilibrium of coplanar force systems.

UNIT - III:

Friction: Theory of static friction, Laws of friction, applications to single body, connected systems, wedge friction and belt friction.

UNIT - IV:

Analysis of Simple Trusses: Introduction to trusses, analysis of simple trusses using method of joints and method of sections.

UNIT - V:

Centroid and Centre of Gravity:

Centroid of lines and areas from first principles, centroid of composite figures, theorems of Pappus, centre of gravity of bodies and composite bodies.

Text Books:

1. K. Vijaya Kumar Reddy and J. Suresh Kumar, "*Singer's Engineering Mechanics: Statics and Dynamics*", B. S. Publications (SI Units), 3rd edn. Rpt., 2019.
2. A. Nelson., "*Engineering Mechanics*", Tata McGraw Hill, Delhi, 2010.

Suggested Reading:

1. Irving H. Shames, *"Engineering Mechanics",* 4th Edition, Prentice Hall, 2006.
2. R. C. Hibbeler, *"Engineering Mechanics: Principles of Statics and Dynamics",* Pearson Press, 2006.
3. Basudeb Bhattacharyya, "*Engineering Mechanics*", Oxford University Press, 2nd edn., 2016.

20CS C01

PROGRAMMING FOR PROBLEM SOLVING
(Common to all Programs)

Instruction	3 Periods per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
4. Develop in tuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and understand the computing environments for scientific and mathematical problems.
2. Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
3. Choose data types and control structures to solve mathematical and scientific problem.
4. Decompose a problem into modules and use functions to implement the modules.
5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high-level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence, and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping, and nested statements.

Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes, Case study using functions and control statements.

UNIT – III

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting (Selection and Bubble) algorithms, 2-D arrays, matrix operations.

Strings: Introduction, strings representation, string operations with examples. Case study using arrays.

UNIT – IV

Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, dynamic memory allocation, advantages, and drawbacks of pointers.

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions, and enumerated data types.

UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.

Preprocessor Directives: Types of preprocessor directives, examples.

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Text Books:

1. M.T. Somashekar “Problem Solving with C”, 2nd Edition, Prentice Hall India Learning Private Limited 2018
2. AK Sharma, “Computer Fundamentals and Programming”, 2^{nd} Edition, University Press, 2018
3. Pradeep Deyand Manas Ghosh, “Programming in C”, Oxford Press,2nd Edition,2017

Suggested Reading:

1. Byron Gottfried, Schaum’s Outline of Programming with C”, Mc Graw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Reema Tharaja “Introduction to C Programming”, Second Edition, OXFORD Press, 2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm.
2. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

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20CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	4 Hours per Week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	2

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theoretical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes

At the end of the course student will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

Chemistry Lab

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2}& Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2}Potentiometrically using $KMnO_4$ solution
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

Text Books:

1. J. Mendham and Thomas , "Vogel's text book of quantitative chemical analysis", Pearson education Pvt. Ltd. New Delhi ,6^{th} ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg & A.Gulati,; R. Chand & Co. : New Delhi (2011).

Suggested Readings:

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9^{th} revised edition, 2015.

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20CS C02

PROGRAMMING FOR PROBLEM SOLVING LAB
(Common to All Programs)

Instruction	4 Periods per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2

Course Objectives: The objectives of this course are

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and setup program development environment.
2. Design and test programs to solve mathematical and scientific problems.
3. Identify and rectify the syntax errors and debug program for semantic errors
4. Implement modular programs using functions.
5. Represent data in arrays, pointers, structures and manipulate them through a program.
6. Create, read, and write to and from simple text files.

Lab experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

Text Books:

1. Pradeep Dey and Manas Ghosh, "Programming in C", Oxford Press, 2nd Edition, 2017.
2. Reema Tharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

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20ME C02

WORKSHOP / MANUFACTURING PRACTICE

Instruction	5P Hours per week
Duration of SEE	3 Hours
SEE	50Marks
CIE	50 Marks
Credits	2.5

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive &team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes: At the end of the course, the students are able to

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
3. Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
4. Perform various operations in welding, machining and casting processes.
5. Conceptualize and produce simple device/mechanism of their choice.

List of Exercises

CYCLE 1

Exercises in Carpentry

1. To plane the given wooden piece to required size
2. To make a lap joint on the given wooden piece according to the given dimensions.
3. To make a dove tail-joint on the given wooden piece according to the given dimensions.

Exercises in Tin Smithy

1. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
2. To make a scoop.
3. To make a pamphlet box.

Exercises in Fitting

1. To make a perfect rectangular MS flat and to do parallel cuts using Hacksaw
2. To make male and female fitting using MSflats-Assembly1
3. To make male and female fitting using MSflats-Assembly2

Exercises in House Wiring

1. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch, and wiring of one buzzer controlled by a bellpush
2. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket
3. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- ways witches.

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CYCLE 2

Exercises in Casting

1. Study of Sand casting process and its applications.
2. Green sand moulding practice for a single piece pattern
3. Green sand moulding practice for a split pattern with a horizontal core

Exercises in Welding

1. Study of gas welding equipment and process. Identification of flames, making of Butt joint with gas welding.
2. Study of Arc welding process, making Butt joint with DCSP,DCRP
3. Study of Arc welding process, making Lap joint with A.C

Exercises in Machine shop

1. Study of Machine Tools like Lathe, Drilling, Milling and Shaper.
2. Facing, Plain turning and Step turning operations on Lathe machine.
3. Knurling and Taper turning on Lathe machine

Open ended Exercise:

1. Student should produce a component /mechanism by applying the knowledge of any one trade or combination of trades.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I, 2008 and Vol. II, 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I”, Pearson Education, 2008.
2. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.

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20ME C03

ENGINEERING EXPLORATION

Instruction	4 Hours per week
Duration of SEE	Nil
SEE	Nil
CIE	50Marks
Credits	1.5

Prerequisites: Nil

Course Outcomes: At the end of the course, the students are able to

1. Understand the role of an engineer as a problem solver.
2. Identify multi-disciplinary approaches in solving an engineering problem.
3. Build simple systems using engineering design process.
4. Analyze engineering solutions from ethical and sustainability perspectives.
5. Use basics of engineering project management skills in doing projects.

UNIT- I

Role of Engineers: Introduction, science, engineering, technology, engineer, scientist, role of engineer, various disciplines of engineering, misconception of engineering, expectations for the 21st century engineer and NBA graduate attributes.

Engineering problems and Design: Multidisciplinary facet of design, pair wise comparison chart, introduction to econometrics system, generation of multiple solution, Pugh chart, motor and battery sizing concepts, introduction to PCB design.

UNIT- II

Mechanisms: Basic components of a mechanism, degrees of freedom or mobility of a mechanism, 4-bar chain, crank rocker mechanism, slider crank mechanism, simple robotic arm building.

Platform-based development: Introduction to programming platforms (Arduino) and its essentials, sensors, transducers and actuators and their interfacing with Arduino.

UNIT- III

Data Acquisition and Analysis: Types of data, descriptive statistics techniques as applicable to different types of data, types of graphs and their applicability, usage of tools (MS-Office /Open Office/ Libre Office / Scilab) for descriptive statistics, data acquisition (temperature and humidity) using sensors interfaced with Arduino, exporting acquired data to spreadsheets, and analysis using representation.

UNIT- IV

Process Management: Introduction to Agile practice, significance of team work, importance of communication in engineering profession, project management tools, checklist, timeline, Gantt chart, significance of documentation.

UNIT -V

Engineering Ethics & Sustainability in Engineering: Identifying Engineering as a profession, significance of professional ethics, code of conduct for engineers, identifying ethical dimensions in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas.

Sustainability in Engineering: Introduction, sustainability leadership, life cycle assessment, carbon foot print.

Text Books:

1. Clive L. Dym, Patric Little, Elizabeth J Orwin, “Engineering Design: A project-based introduction”, 4th edition, Willey.
2. Matthew Python, “Arduino programming for beginners”, Independently published, 2020.
3. Patrick F. Dunn , “Measurement and data Analysis for engineering and science” , thirdedition, 2014.
4. Andrew Stellman, Jennifer Greene, “Head First Agile: A brain-friendly guide to Agile principles, ideas, and real-world practices”, Kindle Edition.

Suggested Reading:

1. Charles B. Fleddermann, “Engineering ethics”, fourth edition, Prentice Hall, 2012.
2. Rob Lawlor, “Engineering in society”, second edition, Royal academy of engineering.
3. Richard Dodds, Roger Venables, “Engineering for sustainable development: Guiding principles”, The Royal Academy of engineering, 2005.
4. Richard S. Paul, “Robot Manipulators: Mathematics, Programming, and Control”, MIT Press.

ENGINEERING EXPLORATION ASSESSMENT SCHEME				
S. No	**Name of the module**	**Work Hours**	**Marks**	**Evaluation**
1	Role of Engineers	4	-	Evaluation - I
2	Engineering Design	16	5	
3	Mechanisms	6	3	
4	Engineering Ethics	2	2	
5	Platform-based Development	16	5	Evaluation - II
6	Data Acquisition and Analysis	6	4	Evaluation-III
7	Project Management	4	4	
8	Sustainability in Engineering	6	2	
9	Course Project Reviews	12	20	Final Evaluation
10	Code of conduct	-	5	
	Total	**72**	**50**	

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20MT C06

VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS
(Common to ECE, EEE, MECH, CHEM, CIVIL)

Instruction	3 L+1T /2P Hours per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives:
1. To explain double and triple integrals of various functions and their significance.
2. To explain Scalar and vector functions with its Physical interpretations.
3. To discuss vector line, surface and volume integrals.
4. To explain relevant methods to solve first order differential equations.
5. To discuss the solution of higher order differential equations.

Course Outcomes:
Upon completing this course, students will be able to:
1. Calculate the areas and volumes.
2. Apply the vector differential operators to Scalars and Vector functions.
3. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
4. Calculate the solutions of first order linear differential equations.
5. Solve higher order linear differential equations.

UNIT-I
Multivariable Calculus (Integration): Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Area enclosed by plane curves, Triple integrals, Volumes of solids.

UNIT-II
Vector Differential Calculus: Scalar and vector point functions, Gradient, Directional derivative, potential function. Divergence, Physical interpretation of Divergence, Curl, Physical interpretation of curl, vector identities.

UNIT-III
Vector Integral Calculus: Line integral, Surface integral and Volume integral, Green's theorem in a plane, Stoke's theorem and Gauss's divergence theorem (without proof)**.**Fluid flow, Physical interpretation of the divergence.

UNIT-IV
First Order Ordinary Differential Equations: Exact differential equations, Equations reducible to exact equations, Linear equations, Bernoulli's equation, Clairaut's equation, Riccati's equation, Orthogonal trajectories, Chemical reactions and solutions, Rate of decay of Radio-active materials.

UNIT-V
Higher Orders Linear Differential Equations: Higher order linear differential equations with constant coefficients, rules for finding Complementary function, Particular Integral and General solution. Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point, regular singular point and Power Series solution. Applications: LR and LCR circuits.

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P.Bali and Dr.Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 9th edition, 2014.
2. R.K.Jain, S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson, Reprint, 2002

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20 EG C01

ENGLISH
(Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	2

Course Objectives: This course will introduce the students:

1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

Course Outcomes: After successful completion of the course the students will be able to:

1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques

UNIT-I Understanding Communication in English:
Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.
Vocabulary & Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT-II Developing Writing Skills I:
Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.
Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT-III Developing Writing Skills II:
Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response
Vocabulary and Grammar: Subject-verb agreement.
Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

UNIT-IV Developing Writing Skills III:
Report writing – Importance, structure, elements of style of formal reports ; Writing a formal report.
Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

UNIT-V Developing Reading Skills:
The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar: Words often confused; Use of standard abbreviations.

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Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP. 1995.

Suggested Readings:

1. Wood F.T, Remedial English Grammar,Macmillan, 2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, Communication Skills. Oxford University Press, 2011.

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20PY C06

ELECTROMAGNETIC THEORY AND QUANTUM MECHANICS
(Common to ECE & EEE)

Instruction	3L / Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

The objectives of the course is to make the student

1. Understand the fundamentals of wave nature of light
2. Familiar with static and dynamic nature of electric and magnetic fields
3. Acquire knowledge of lasers and fiber optics
4. Learn basics of quantum mechanics and properties of solids

Course Outcomes:

At the end of the course, the student will be able to

1. Interpret the wave nature of the light
2. Extend the laws of electric and magnetic fields for wireless communication
3. Explain the principles of lasers and fiber optic communication
4. Find the applications of quantum mechanics
5. Identify semiconductors for engineering applications

UNIT-I

Wave Optics: Huygens' principle – Superposition of waves – Interference of light by wave front splitting and amplitude splitting –Interference in thin films (reflected light) – Newton's rings – Fraunhofer diffraction from a single slit – Double slit diffraction–Concept of N-slits–Diffraction grating. Polarization: Introduction–Malus's law –Double refraction –Nicol's prism–Quarter-wave plate and half-wave plate– Optical activity– Laurent's half shade polarimeter.

UNIT-II

Electrostatics: Calculation of electric field and electrostatic potential for a charge distribution–Divergence and curl of electrostatic field– Laplace's and Poisson's equations for electrostatic potential–Uniqueness theorem.

Magnetostatics: Bio-Savart law–Divergence and curl of static magnetic field –Equation for magnetic vector potential and its solution for given current densities – Feromagnetic, paramagnetic and diamagnetic materials– B-H curve.

Electromagnetic Theory: Review of steady and varying fields – Conduction current and displacement current–Maxwell's equations indifferential and integral forms–Electromagnetic wave propagation in free space, dielectric and conducting media – Poynting theorem – Skindepth.

UNIT-III

Lasers: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion – Ruby laser – He-Ne laser – Semiconductor laser –Applications of lasers in engineering and medicine.

Fiber Optics: Introduction –Construction –Principle –Propagation of light through an optical fiber – Numerical aperture and acceptance angle – Step-index and graded-index fibers –Pulse dispersion –Fiber losses –Fiber optic communication system –Applications.

UNIT-IV

Quantum Mechanics: Introduction –Wave nature of particles – de-Broglie hypothesis –Physical significance of ψ –Time-dependent and time-independent Schrodinger equations – Born interpretation – Probability current –Wave-packets –Uncertainty principle –Particle in infinite square well potential.

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UNIT-V

Physics of Solids and Semiconductors: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level – Bloch's theorem for particles in a periodic potential –Kronig-Penney model – Origin of energy bands –Classification of solids: metals, semiconductors and insulators –Intrinsic and extrinsicsemiconductors–Carriergenerationandrecombination–Carriertransport:diffusionanddrift–P-N junction – Thermistor – Hall effect – LED – Solarcell.

Text Books:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

Suggested Reading:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

20EEC01

BASIC ELECTRICALENGINEERING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To understand the behaviour of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis
2. To understand the basic principle of operation of AC and DC machines
3. To know about different types of electrical wires and cables, domestic and industrial wiring. safety rules and methods of earthing

Course Outcomes: After the completion of this course, the student will be able to

1. Understand the concepts of Kirchhoff's laws and to apply them in superposition, Thevenin's and Norton's theorems to get the solution of simple dc circuits
2. Obtain the steady state response of RLC circuits with AC input and to acquire the basics, relationship between voltage and current in three phase circuits.
3. Understand the principle of operation, the emf and torque equations and classification of AC and DC machines
4. Explain various tests and speed control methods to determine the characteristic of DC and AC machines.
5. Acquire the knowledge of electrical wiring, types of wires, cables used and Electrical safety precautions to be followed in electrical installations.
6. Recognize importance of earthing, methods of earthing and various low-tension switchgear used in electrical installations

UNIT-I

DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of first-order RL and RC circuits.

UNIT-II

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III

Transformers: Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation

UNIT-IV

DC and AC Machines: DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators.

DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors.

Three - Phase Induction Motors: Principle of operation, Applications,

UNIT-V

Electrical Installations: Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules.

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Earthing (Elementary Treatment only), Elementary calculations for energy consumption

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Text Books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989
3. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
4. P.V. Prasad, S. Sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013

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with effect from the Academic Year 2020-21

20EG C02

ENGLISH LAB
(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives: This course will introduce the students:

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behavior while developing their ability to discuss in groups and making oral presentations.

Course Outcomes: After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams ,and discuss and participate in Group discussions.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm & Intonation**: Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material
6. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary –** weaving an imaginative story around a given picture.
9. **Information Gap Activity –** Writing a brief report on a newspaper headline by building on the hints given
10. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt. Ltd., 2011
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016

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20PY C09

ELECTROMAGNETIC THEORY AND QUANTUM MECHANICS LAB
(Common to ECE & EEE)

Instruction	4 Periods / Week
Duration of External Assessment	3 Hours
External Assessment	50 Marks
Internal Assessment	50 Marks
Credits	2

Course Objectives:

The objectives of the course is to make the student

1. Apply the concepts of physics while doing experiments
2. Understand the nature of the light experimentally
3. Analyze the behaviour of semiconductor materials and optoelectronic devices

Course Outcomes:

At the end of the course, the student will be able to

1. Experiment with the concept of errors and find the ways to minimize the errors
2. Demonstrate properties of light experimentally
3. Find the applications of lasers and optical fibers in engineering applications
4. Make use of semiconductor devices for practical applications
5. Illustrate the working of optoelectronic devices

Experiments

1. Error Analysis	:	Estimation of errors in the determination of time period of a torsional pendulum
2. Newton's Rings	:	Determination of wavelength of given monochromatic source
3. Single Slit Diffraction	:	Determination of wavelength of given monochromatic source
4. Diffraction Grating	:	Determination of wavelengths of two yellow lines of light of mercury lamp
5. Malus's Law	:	Verification of Malus's law
6. Double Refraction	:	Determination of refractive indices of O-ray and E-ray of given calcite crystal
7. Polarimeter	:	Determination of specific rotation of glucose
8. Laser	:	Determination of wavelength of given semiconductor laser
9. Optical Fiber	:	Determination of numerical aperture and power losses of given optical fiber
10. Energy Gap	:	Determination of energy gap of given semiconductor
11. P-N Junction Diode	:	Study of V-I characteristics and calculation of resistance of given diode in forward bias and reverse bias
12. Thermistor	:	Determination of temperature coefficient of resistance of given thermistor
13. Hall Effect	:	Determination of Hall coefficient, carrier concentration and mobility of charge carriers of given semiconductor specimen
14. LED	:	Study of I-V characteristics of given LED
15. Solar Cell	:	Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance

NOTE: A minimum of TWELVE experiments should be conducted.

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20EEC02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements and to verify the basic electrical circuit laws and theorems.
2. To determine the parameters and power factor of a coil, calculate the time and frequency responses of RLC circuits and to familiarize with measurement of electric power & energy.
3. To determine the characteristics of Transformers, dc, ac machines and switch gear components

Course Outcomes: At the end of the course, the students are expected to

1. Get an exposure to common electrical components, their ratings and basic electrical measuring equipment.
2. Make electrical connections by wires of appropriate ratings and able to measure electric power and energy.
3. Comprehend the circuit analysis techniques using various circuital laws and theorems.
4. Determine the parameters of the given coil and calculate the time response of RL & RC series circuits.
5. Recognize the basic characteristics of transformer and components of switchgear.
6. Understand the basic characteristics of dc and ac machine by conducting different types of tests on them.

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components.
2. Verification of KCL and KVL.
3. Time response of RL and RC series circuits.
4. Determination of parameters of a choke or coil by Wattmeter Method
5. Verification of Thevenin's and Norton's theorems
6. Turns ratio /voltage ratio verification of single phase Transformers
7. Open Circuit and Short Circuit tests on a given single phase Transformer
8. Observation of Excitation Phenomenon in Transformer
9. Measurement of three phase power in a balanced system using two Wattmeter method.
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle)
11. Load test on DC Shunt motor
12. Speed control of DC Shunt motor
13. Demonstration of Low Tension Switchgear Equipment/Components
14. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: TEN experiments to be conducted from the above list.

20ME C01

CAD AND DRAFTING

Instruction	1 T + 3 D Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives:
1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

Outcomes: At the end of the course, the Students are able to
1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

List of Exercises:
1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice versa.

Text Books:

1. N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishers, 2012.
2. K.Venugopal, “Engineering Drawing and Graphics + AutoCAD”, New Age International Pvt. Ltd, 2011.
3. Basanth Agrawal and C M Agrawal, “Engineering Drawing”, 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., “Engineering Drawing”, 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011.

20MBC02

COMMUNITY ENGAGEMENT

Instruction	3 Hours per week (30 hours field work & 2 hours per week)
SEE	Nil
CIE	50 Marks
Credits	1.5 Credits

Course Objectives: The main Objectives of this Course are to:
1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

Course Outcomes: After the completion of this Course, Student will be able to:
2. Gain an understanding of Rural life, Culture and Social realities.
3. Develop a sense of empathy and bonds of mutuality with Local Communities.
4. Appreciate significant contributions of Local communities to Indian Society and Economy.
5. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
6. Utilise the opportunities provided by Rural Development Programmes.

Module I Appreciation of Rural Society
Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

Module II Understanding Rural Economy and Livelihood
Agriculture, Farming, Landownership, Water management, Animal Husbandry, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III Rural Institutions
Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees, Local Civil Society, Local Administration.

Module IV Rural Development Programmes
History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

Text Books:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

Journals:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).

18MT C07

APPLIED MATHEMATICS
(For ECE and EEE)

Instruction	3 L+1T Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course aims to:

1. Form PDE and solve Linear and Non-Linear equations.
2. Learn the Laplace, Inverse Laplace Transform and Z-Transforms.
3. Find roots of equations, interpolation and Numerical differentiation.
4. Learn Numerical solution of ODE and Engineering problems.
5. Learn fitting of distribution and predicting the future values.

Course Outcomes: On successful completion of this course the students shall be able to:

1. Understand the methods to find solution of linear and non-linear PDE and solution of wave equation.
2. Find Laplace, Inverse Laplace and Z-Transforms and solution of engineering problems.
3. Solve Non-Linear algebraic and transcendental equations to find interpolations when tabular values are given.
4. Find solution of initial value problems of ODE.
5. Understand the Methods for analysing the random fluctuations using probability distribution and also identify the importance of principle of Least squares approximations for predictions.

UNIT-I

Partial Differential Equations: Formation of Partial Differential Equations, Solution of Linear (Lagrange's) and Non-linear PDE of First order standard forms and Charpit's Method, Solutions of PDE by method of separation of variables, solution of one dimensional wave equation and its applications.

UNIT-II

*Transform Theory:*Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by partial fractions and residue method, solving ODEs by Laplace Transform method.Z-transforms and its basic properties, inverse Z-transform and solutions of difference equation by Z-transform.

UNIT-III

Numerical Analysis: Solution of Algebraic and transcendental equations by Bisection method, Newton-Raphson method and Regula-Falsi method. Interpolation, Newton's forward and backward difference formulae.Newton's divided difference and Lagrange's formulae.Numerical Differentiation.

UNIT-IV

Numerical Solutions of ODE: Solutions of First Order Ordinary differential equations, Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator corrector methods

UNIT-V

Basic Statistics: Measures of Central tendency for continuous random variable, Moments, skewness and Kurtosis, Probability distributions: Normal (Gaussian), Rayleigh, Exponential and uniform distributions Correlation and regression. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas.

Text Books:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, "Numerical Methods", S. Chand & Company, 2nd Edition, Reprint 2012.
2. S.S. Sastry, "Introductory methods of numerical analysis", PHI, 4th Edition, 2005.
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 35th Edition, 2010.
4. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

Suggested Reading:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2008.
3. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

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18CS C05

BASICS OF DATA STRUCTURES
(Common to all Programs except CSE & IT)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	20 Marks
Credits	2

Pre-requisite: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some
mathematical maturity also will be expected.

Course Objectives: This course aims to:

1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different sorting and searching techniques and their complexities.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Understand the basic concepts of data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Choose and apply an appropriate data structure for a specified application.
4. Understand the concepts of recursion and its applications in problem solving.
5. Demonstrate a thorough understanding of searching and sorting algorithms.

UNIT-I

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff. *Recursion*: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT-II

Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

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UNIT-III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications.

UNIT-IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT-V

Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees. *Searching and Sorting*: Linear searching, binary Searching, sorting algorithms- bubble sort, selection sort, quick sort, heap sort.

Text Books:

1. Narasimha karumanchi, Data Structures and Algorithms Made Easy, CareerMonk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, Fundamentals of Data structures in C,E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, Data Structures using C, Oxford University Press.

Suggested Reading:

1. D.S.Kushwaha and A.K.Misra, Data structures A Programming Approach with C, PHI.
2. Seymour Lipschutz, Data Structures with C, Schaums Outlines, Kindle Edition

Online Resources:

1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data-structures-1#DS

18EC C01

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

Instruction	3 LHours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have prior knowledge about circuit theory, coordinate systems and vector calculus.

Course Objectives: This course aims to:

1. The mathematical fundamentals necessary for understanding the electromagnetic theory.
2. The electrostatics and magnetics along with Maxwell's equations for EM Waves.
3. The concepts of transmission lines

Course Outcomes: Upon completion of this course, students will be able to:

1. Comprehend mathematically the coordinate systems and solve simple static Electromagnetic problems using various laws and theorems.
2. Understand Maxwell's equations in different forms (differential and integral) and apply them to diverse engineering problems.
3. Demonstrate the Electromagnetic wave properties with respect to different transmission mediums.
4. Predict the behavior of reflection and refraction of the waves in different mediums.
5. Estimate the transmission line properties, reflection and matching concepts.

UNIT-I

Review of coordinate systems, Coulomb's Law, Electric field, Electric flux, flux density and Gauss Law. Potential and Potential gradient.Laplace's and Poisson's equations.Current, Current Density and Continuity of current equation.

UNIT-II

Biot-Savart's law, Ampere's law, Magnetic flux and Magnetic flux density. Gauss law for magnetic fields, Vector magnetic potential. Boundary conditions.Time varying fields, Maxwell equations: Integral form and Point form.

UNIT-III

Wave equations, Uniform plane waves in lossy and lossless medium. Skin Depth, Polarization, Instantaneous and average Poynting theorem and its applications. Reflection and Refraction of Plane Waves - Normal and Oblique Incidence for perfect Conductor and perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection.

UNIT-IV

Transmission Lines - I: Types, Parameters, Transmission Line Equations, Primary and Secondary Constants, Characteristics Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line. Impedance at any point on the transmission line.

UNIT-V

Transmission Lines - II: RF and UHF Lines, Open and short circuit lines and their significance. Properties of ë/2, ë/4 and ë/8 Lines. Distortion and distortion less transmission line, Concept of loading of a transmission line, Campbell's formula. Reflection and VSWR. Matching: Quarter wave transformer, Single Stub matching. Smith chart and its applications.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics", 7th edition, Newyork Oxford University Press, 2018.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", 8th edition, TMH, 2016.
3. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd edition, PHI, 2000.

Suggested Reading:

1. John D. Ryder, "Networks Lines and Fields", 2nd edition,PHI, 2015.
2. R.K. Shevgaonkar, "Electromagnetics Waves", Tata McGraw Hill India, 2005.

18EC C02

ELECTRONIC DEVICES

Instruction	3 LHours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have the knowledge of semiconductor fundamentals.

Course Objectives: This course aims to:

1. The concepts of semiconductor devices like PN junction diode, Transistor, and special diodes.
2. The applications of diodes.
3. The various configurations, characteristics of transistors – BJT, JFET & MOSFET.

Course Outcomes: Upon completion of this course, students will be able to:

1. Recall the elementary concepts of diode and relate them to special devices. Students will also be able to define the working principles of BJT, FET
2. Classify and relate the performance of different types of rectifiers. Students will be able to compare and contrast the biasing techniques, different configurations, characteristics of BJT & FET
3. Examine different non-linear wave shaping circuits and draw an inference for their outputs. Students will be able to distinguish different types of rectifying circuits and amplifier circuits and their performance parameters.
4. Choose the best configuration for the specifications.
5. Understand the flow of IC fabrication.

UNIT – I

Semiconductor Diode Characteristics: The p-n junction Diode, Energy band diagram, Current equations, I-V characteristics, Temperature dependence, Diode resistance, Transition capacitance, Diffusion capacitance, Zener diode - Regulator, Schottky diode.

UNIT – II

Diode Applications: Diode as a circuit element, Clipping and Clamping circuits, Clamping circuit theorem. Half wave, Full wave and Bridge Rectifiers - their operation, performance characteristics- ripple factor calculations, and analysis; Filters (L, C, LC and CLC filters).

UNIT – III

Bipolar Junction Transistor: Construction and Operation of NPN and PNP transistor, current components and current flow in BJT, Modes of transistor operation, Early effect, BJT input and output characteristics of CB, CE,CC configuration- h-parameters.

UNIT – IV

Field Effect Transistor:Junction Field Effect Transistor: The Pinch-off Voltage V_P, V-I characteristics of JFET.
MOSFETs: Enhancement & Depletion mode MOSFETs, V-I characteristics, MOSFET as resistance, Small signal models of MOS transistor, Biasing of MOSFETs, MOSFET as a switch.

UNIT – V

Elementary treatment of SCR- UJT- Diac- Triac - Tunnel diode.LED, Photodiode, Solar cell.Introduction to Integrated circuit fabrication process: Oxidation, Diffusion, Ion implantation, Photolithography, Etching, Metallization, Twin-tub CMOS process.

Text Books:

1. Millman and Halkias, " Electronic Devices and Circuits" 2nd Edition, McGraw Hill Publication, 2007.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.
3. S.K. Gandhi, "VLSI Fabrication Principles: Silicon and Gallium Arsenide", Wiley India Pvt. Ltd., New Delhi, 2ndedn. 1994.

Suggested Reading:

1. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press 2008.
2. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
3. Christian Piguet, "Low Power CMOS Circuits Technology, Logic Design and CAD Tools" 1st Indian Reprint, CRC Press, 2010.

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18EC C03

NETWORK THEORY

Instruction	3 LHours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge on Elements of Electrical Engineering.
Course Objectives: This course aims to:

1. Make understand the concepts of Electric Circuits, Network Theorems and the transients.
2. Make understand the concept of steady state and applying phasor analysis to AC circuits and analyzing magnetic coupled circuits.
3. Familiarize resonant circuits, two port network parameters, concept of Passive Filters and Network Synthesis.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the basics of electrical circuits with nodal, mesh analysis and network theorems.
2. Apply Laplace Transform for steady state and transient analysis.
3. Analyze the phasor representation for ac circuits and magnetic coupled circuits.
4. Describe resonance circuits, two port network parameters and their interconnections.
5. Synthesize various forms of electrical networks.

UNIT-I

*Network Theorems:*Network reduction techniques, Super Nodal and Super Mesh Analysis, Superposition, Thevenin's and Norton's theorems.Reciprocity, Maximum Power Transfer, Compensation, Millman's, Duality and Tellegen's Theorems using dependent and independent sources.

UNIT-II

Transients: Introduction, Study of initial conditions, DC transients RL, RC circuits, RLC circuits, Formulation of integral, differential equations. Circuit analysis using Laplace Transform and inverse Laplace Transform, Pole-Zero Plots, Zero Input Response, Zero State Response.

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UNIT-III

Steady State Analysis of AC Circuits: Phasor and vector representations, impedance and admittance, Average power, Apparent Power, Complex Power, Power triangle.

Coupled circuits: Concept of self, mutual inductance, co-efficient of coupling, dot convention rules and analysis of simple circuits.

UNIT-IV

Frequency Domain Analysis: Concept of complex frequency, impedance and admittance functions, Series and parallel resonance, Q-factor, selectivity, bandwidth.

Two Port Networks: Z, Y, h, g, ABCD and Inverse ABCD parameters, equivalence of two port networks. Inter connection of two port networks.

UNIT-V

Filters: Introduction to Filters and classification of Filters (Low pass, High pass, Band pass and Band stop) and their design aspects. *Network Synthesis:* Elements of circuit synthesis, Foster and Cauerforms of LC, RC and RL networks.

Text Books:

1. William H.Hayt, Jr.,Jck E. Kemmerly and Steven M.Durbin, "Engineering Circuit Analysis", 8th edition, McGraw Hill, 2013.
2. Vanvalkenberg M.E, "Network analysis", PHI, New Delhi, 3rd Edition 2002.

Suggested Reading:

1. C.L.Wadhwai, "Network Analysis and Synthesis", 4th edition, New Age Publications, 2016.
2. Sudhakar. A. and Shyammohan, S. P., "Circuits and Network", Tata McGraw-Hill New Delhi, 1994.

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18EC C04

SIGNALS AND SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of Differential and Integral Calculus.

Course Objectives: This course aims to:

1. Know Signals and systems representation/classification and also the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
2. Understand Sampling, time and frequency domain analysis of discrete time signals with DTFT and Z-Transforms.
3. Understand concepts of convolution and correlation integrals.

Course Outcomes: Upon completion of this course, students will be able to:

1. Define and Classify signals, systems and analyse the signals using Fourier series.
2. Understand signal spectrums and characterize the systems.
3. Assess the system stability, causality using ROC and Pole-Zero Plot.
4. Demonstrate conversion of continuous time signal to discrete time signal and obtain discrete system characteristics using DTFT and Z Transform.
5. Apply the Convolution concept to calculate the output of the system and compare the signals.

UNIT-I

Continuous Time Signals: Introduction to signals, their representations and classification. Introduction to systems and their classifications, Orthogonality of signals, Complete set of mutually orthogonal signals, Harmonic signals. *Signal Representation*: Exponential Fourier series, Existence and Convergence. Symmetry conditions, Amplitude and Phase spectra. Power Spectral Density.

UNIT-II

Fourier Transforms: The direct and inverse Fourier transforms, Existence, Frequency spectrum and properties of Fourier Transforms, Fourier Transform of singularity functions and periodic signals. Energy Spectral Density, Filter

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characteristics of linear systems, Distortion less system, Phase delay and group delay.

UNIT-III

Signal Representation by Generalized Exponentials: The Bilateral and unilateral Laplace transforms. Region of convergence and its properties. Properties of Laplace transform, Inverse Laplace transform, Laplace transform of periodic signals.

LTI System: Impulse response, System transfer function, Stability and Causality.

UNIT-IV

Discrete Time Signals: Sampling of continuous time signals. DTS representation.Discrete Time Fourier Transform and properties.

Z–Transform: The Direct Z-Transform, Region of convergence and its properties. S–Plane and Z–Plane correspondence, Z–Transform properties. Inverse Z–Transform, Discrete LTI system: impulse response and system transfer function. Stability and Causality.

UNIT-V

Convolution: Continuous convolution, Graphical interpretation and its properties. Discrete convolution and its properties.

Correlation: Continuous correlationCross correlation, Auto correlation and properties. Discrete correlationCross correlation, Auto correlation and properties.

Text Books:

1. B.P.Lathi, "Signals, Systems and Communications", BS Publications, 3rd Edition, 2008.
2. Simon Haykin, "Signals and Systems", Wiley India, 5th Edition,2009.

Suggested Reading:

1. Alan V. Oppenheim,Alan S. Willsky,S.HamidNawad, "Signals and Systems", PHI 2nd Edition, 2015.
2. M.J. Robert, "Fundamentals of signals and systems", McGraw Hill, 2008.

18CE M01

ENVIRONMENTAL SCIENCE

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: Upon completion of this course, the student will be able to:

1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT-I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT-II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT-III

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT-IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT-V

Social Issues and The Environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria& Sons, 2009.

Suggested Reading:

1. C. S. Rao, "Environmental Pollution Control Engineering", Wiley, 1991.
2. S. S. Dara, "A Text Book of Environmental Chemistry &Pollution Control", S. Chand Limited, 2006.

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18CS C06

BASICS OF DATA STRUCTURES LAB

(Common to all Programs except CSE & IT)

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Pre-requisite: Knowledge on any Programming Language (C)

Course Objectives: This course aims to:

1. Design and construct simple programs by using the concepts of Data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills and strengthen practical ability to apply suitable data structure for real time applications.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implement non-linear data structures such as trees, graphs and its traversal techniques.
4. Implement various kinds of searching, sorting techniques.
5. Develop the suitable data structure for real world problem.

List of Experiments

1. Implementation of operations on arrays.
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of Sorting techniques.
7. Case study like Banking System, Students Marks Management, Canteen Management etc.

Text Books:

1. Brian W Kernighan, Dennis Ritchie, C Programming Language, PH PTR, 2nd Edition.
2. Richard M Reese, Understanding and Using C Pointers, O'Reily, 2013.

Online Resources:

https://nptel.ac.in/courses/106102064/

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18EC C05

ELECTRONIC DEVICES LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Students have the knowledge of semiconductor fundamentals.

Course Objectives: This course aims to:

1. Know V-I characteristics of diodes and special semiconductor devices.
2. Design and performance evaluation of various diodes as rectifiers.
3. Understand the characteristics of transistor in various configurations.

Course Outcomes: Upon completion of this course, students will be able to:

1. Recall the elementary concepts of diode, BJT, FET.
2. Classify and relate the performance of different types of rectifiers. Compare and contrast different configurations and characteristics of BJT & FET.
3. Distinguish different types of rectifying circuits and their performance parameters.
4. Choose the best configuration for the specifications provided.
5. Understand the behavior of various special diodes.

List of Experiments:

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances.
2. Zener diode characteristics and its application as voltage regulator.
3. Clipping and Clamping Circuits.
4. Design, realization and performance evaluation of half wave rectifiers without filters and with C & ð section filters.
5. Design, realization and performance evaluation of full wave rectifiers without filters and with C & ð section filters.
6. Plotting the characteristics of BJT in Common Base configuration and measurement of h-parameters.
7. Plotting the characteristics of BJT in Common Emitter configuration and measurement of h-parameters.
8. Plotting the characteristics of BJT in Common Collector configuration and measurement of h-parameters.

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9. Plotting the characteristics of JFET in CS configurations and measurement of Transconductance and Drain resistance.
10. Characteristics of special semi-conductor devices-UJT and SCR.
11. Characteristics of LED and photo diode.
12. Characteristics of Tunnel diode.

Note: Wherever possible, Analysis and design of circuits shall be carried out using simulation tools.

Suggested Reading:

1. Robert Diffenderfer, "Electronic Devices Systems and Applications", Cengage Learning India Private Limited,2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics, A Text - Lab Manual", 7th Edition, TMH 2001.
3. Mahesh Jain, "Practical semiconductors data manual No.3", BPB Publications, 1981.
4. Bharath electronics ltd, "Semiconductors data manual", IEC Publication 134, 1969.

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18EC C06

ELECTRONIC WORKSHOP AND NETWORKS LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge of *b*asic Electrical components, circuits and equipment.

Course Objectives: This course aims to:

1. Understand the basic Concepts of Electric Circuits and equipment like CRO, Multimeter and LCR –Q meter
2. Verify network theorems.
3. Analyse Resonant circuits, Attenuators and passive filters.

Course Outcomes: Upon completion of this course, students will be able to:

1. Measure R, L, C components using electronic equipment.
2. Analyse DC, AC circuits and verify network theorems.
3. Determinethe two port network parameters.
4. Design and verification of attenuators and filters.
5. Simulate different circuits using the simulation software.

EXPERIMENTS LIST

1. Study of RLC components, Bread board, Regulated power supply, Function generator, CRO
2. Measurement of R, L, C components using colour code, multimeter and LCR - Q Meter.
3. Practice of Soldering and de-soldering for simple circuits.
4. Verification of Superposition theorem and Tellegen's theorem.
5. Verification of Maximum power transfer theorem.
6. Verification of Reciprocity theorem.
7. Verification of Compensation theorem andMillman'stheorem.
8. Verification of Transient Response in RC, RL circuits.
9. Design and Verification of Series Resonance.
10. Design and Verification of Parallel Resonance.
11. Determination of two-port network parameters (Z,Y,h,T).
12. Design and Verification of Attenuators.
13. Design andVerification of Constant-K high-pass filter.
14. Design andVerification of Constant-K low-pass filter.

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Note: Experiments are to be simulated by using any simulation software.

Suggested Reading:

1. Thomas Petruzzellis, "Build Your Own Electronics Workshop", McGraw-Hill Companies, Inc., 2005.
2. A.M. Zungeru, J.M. Chuma, M. Mangwala , L.K. Ketshabetswe, "Handbook of Laboratory Experiments in Electronics and Communication Engineering" Vol. 2, 1st Edition, Notion press, 2017.

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18EG C03

SOFT SKILLS

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: This course aims to:

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise 1
Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self-confidence and assertiveness, stress management, moral values.
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)
Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise 2
Main Topics: Advanced Group Discussion with Case studies : Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

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Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)
Writing Input: Writing with Precision - Writing Abstracts

Exercise 3
Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions &Practice)
Writing Input: Writing to Reflect - Resume Writing

Exercise 4
Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity
Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)
Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5
Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar.Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)
Writing Input: Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010
4. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

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18EC C07

ANALOG CIRCUITS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Student should have knowledge on Electronic Devices and Network Analysis.

Course Objectives: This course aims to:

1. Understand the applications of BJT & FET as a switch and an amplifier.
2. Analysis of BJT & FET in various configurations using small signal equivalent models and their frequency response.
3. Know concept of multistage, feedback amplifiers, multivibrators and power amplifier and their analysis.

Course Outcomes: Upon completion of this course, students will be able to:

1. Define the equivalent model of BJT, FET & MOSFET at low and high frequency.
2. Compare and Contrast different types of Multistage, Feedback, Power amplifiers, Multi-vibrators
3. Apply the concepts of BJT analysis in feedback amplifiers, multistage amplifiers
4. Categorize different types of feedback amplifiers, power amplifiers and Multi-vibrators.
5. Choose the best configuration for the specifications (like conversion efficiency in case power amplifiers, input and output impedance in case feedback amplifiers

UNIT-I

Biasing of Amplifiers: BJT biasing techniques, stability factors, Bias compensation techniques, Thermal runaway, Thermal stability, BJT as an amplifier and as a switch. JFET biasing-zero current drift biasing, biasing of FET, FET as an amplifier and as a switch. Biasing of MOSFETs, MOSFET as a switch.

UNIT-II

Single Stage Amplifiers: Analysis of BJT circuits using h-parameters in various configurations, their comparison (approximate and exact analysis), Millers Theorem and its duality- application circuits, frequency response. Analysis of

FET circuits using equivalent model for various configurations and their comparison.

UNIT-III

Multi Stage Amplifiers: Multi stage amplifiers: CE-CE, CE-CB, CC-CC, Bootstrap, High frequency equivalent circuit Analysis BJT (f_T, f_{β}, and gain band-width product), Amplifier Frequency response, Multistage amplifiers: low frequency and High frequency analysis of RC coupled, Transformer coupled and Direct coupled amplifiers with BJT.

UNIT-IV

Feedback Circuits: Feed Back Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances, Voltage and current, series and shunt feedbacks. Stability considerations. Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC oscillator, LC oscillator, Crystal oscillator, Amplitude and frequency stability of oscillator.

UNIT-V

Large Signal Amplifies and Multivibrators: Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Push-Pull audio power amplifiers under Class-A, Class-B operations, Heat Sinks. Analysis of Transistor Multivibrators: Bistable, Monostable and Astable circuits. Operation of regenerative comparator (Schmitt Trigger).

Text Books:

1. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
2. Millman and Halkias, "Electronic Devices and Circuits" 2nd Edition, McGraw Hill Publication, 2007.
3. Jacob MillmanHerbert TaubMillman's, "Pulse, Digital and Switching Waveforms", Third Edition, McGraw Hill Publication, 2017.

Suggested Reading:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.
3. Donald Schilling, Charles Belove, TuviaApelewicz Raymond Saccardi, "Electronic Circuits: Discrete andIntegrated", TMH, 3rd Edition, 2012.

18EC C08

ANALOG COMMUNICATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of signals and systems is required.

Course Objectives: This course aims to:
1. Introduce the fundamentals of analog communication.
2. Provide the design details of various transmitters and receivers used in analog communication system.
3. Involve the students in analyzing performance of communication system by estimating noise.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the need for modulation and various linear modulation schemes.
2. Infer the concepts of various nonlinear modulation schemes.
3. Design various transmitters and receivers.
4. Assess a random signal by computing various statistical properties.
5. Evaluate the performance of analog communication system through the estimation of noise.

UNIT – I

Linear Modulation Schemes: Need for Modulation, Double Side Band Suppressed Carrier Modulation, Balanced Modulator, Coherent Detector and Costas Detector. Conventional Amplitude Modulation, Phasor Diagram of AM, Switching Modulator, Envelope Detector. Hilbert Transform and its Properties. Single Side Band Modulation. Vestigial Side Band Modulation.

UNIT – II

Non-Linear Modulation Schemes: Angle Modulation, Frequency Modulation and Phase modulation, Concept of Instantaneous Phase and Frequency. Types of FM modulation: Narrow Band FM and Wide Band FM. FM Spectrum in Terms of Bessel Functions. Phasor Diagram of NBFM. Direct and Indirect (Armstrong's) methods of FM Generation. Foster–Seeley Discriminator for FM Detection. Introduction toPLL.

UNIT –III

Transmitters and Receivers: High Level and Low Level AM Transmitters. Principle and Operation of Tuned Radio Frequency receiver and Super Heterodyne Receivers.Selection of RF Amplifier.Choice of Intermediate Frequency. Image Frequency and its Rejection Ratio, Receiver Characteristics: Sensitivity, Selectivity, Fidelity. Double Spotting, Tracking and Alignment.Pre-emphasis and De-emphasis.

UNIT –IV

Random Process: Concept of random process, Stationarity and Ergodicity, Auto Correlation and its Properties, Power Spectral Density and its Properties. Linear System with Random inputs: Random Signal Response of Linear System, Auto Correlation of Response.

UNIT – V

*Noise:*Thermal Noise. White Noise and ColouredNoise.Noise Temperature. Noise in Two-Port Network: Noise Figure, Equivalent Noise Temperature and Noise Bandwidth. Noise Figure and Equivalent Noise Temperature for Cascaded Stages. S/N Ratios and Figure of Merit Calculations for AM, DSB-SC and SSB systems.Pulse Analog Modulation Schemes: Sampling of low Pass and Band Pass Signals. Types of Sampling. Pulse Modulation Schemes: PAM, PWM and PPM.

Text Books:

1. Simon Haykin, "Communication Systems",2nd Edition, WileyIndia,2011.
2. Herbert Taub, Donald L. Shilling and GoutamSaha, "Principles of Communication Systems", 3rd Edition, TMH, 2008.
3. Peyton Z. Peebles JR., "Probability Random Variables and Random Signal Principles", Tata McGrawHill, edition, 4/e, 2002.

Suggested Reading:

1. Singh, R.P. and Sapre, S.D., "Communication Systems", TMH, 2007.

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18EC C09

ANTENNAS AND WAVE PROPAGATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have prior knowledge about Electromagnetics theory and Maxwell's equations.

Course Objectives: This course aims to:

1. The basic principles of an antenna and its parameters for characterizing its performance.
2. The fundamental concepts of various types of antennas, arrays for customizing the pattern parameters.
3. The propagation behavior of the radio wave in both troposphere and ionosphere.

Course Outcomes Upon completion of this course, students will be able to:

1. Understand the basic parameters of an antenna.
2. Extend current distribution concept in order to estimate the field patterns.
3. Appraise the concepts of broad side and end fire arrays.
4. Understand the working principle and characteristics of various antennas.
5. Study the behavior of radio waves in various modes of wave propagation.

UNIT-I

Principles of radiation, retarded potential. Isotropic, Directional and Omni-directional radiators.Basic antenna parameters: Radiation patterns, radiation intensity, far field, near field, gain and directivity, Antenna Polarization, effective aperture area and efficiency. Point sources, current distribution, Friis transmission formula.

UNIT-II

Analysis of Infinitesimal dipole, Half-wave dipole, quarter wave monopole, loop antenna and their far field patterns, calculation of radiation resistance and directivity.

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UNIT-III

Concept of Antenna Array. Uniform linear array: Broadside and Endfire arrays and calculation of directivity and beamwidth. Two element array of Infinitesimal dipole.Qualitative treatment of nonlinear arrays: Binomial and Chebyschef arrays

UNIT-IV

Qualitative treatment of Helical Antennas: Normal and Axial mode patterns, wideband characteristics. Characteristics, radiation principles and applications of Rhombic Antenna, Yagi-Udaantenna, pyramidal Horn antenna, Parabolicantenna system, Log-Periodic antenna.Microstrip antennas: Radiation mechanism, different types, advantages and disadvantages. Design of rectangular Microstrip antenna.

UNIT-V

Ground wave propagation, Space and Surface waves, Tropospheric refraction and reflection, Duct propagation.Sky wave propagation: Critical frequency, Maximum Usable Frequency (MUF) and Skip distance, Line of sight propagation.

Text Books:

1. Constantine A. Balanis, "Antenna Theory: Analysis and Design", 4th Edition, John Wiley, 2016.
2. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2001.

Suggested Reading:

1. John D. Krauss, Ronald J. Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation", 4th Edition, TMH, 2010.
2. DennisRoody and John Coolen, "Electronic Communications", 4th Edition, Prentice Hall, 2008.

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18EC C10

CONTROL SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student is expected to have knowledge of Laplace transform and electrical and electronic circuits.

Course Objectives: This course aims to:

1. Introduce various control systems and their equivalent mathematical models, block diagrams and signal flow graphs.
2. Familiarize students to time response analysis of different systems, frequency domain techniques to assess the stability of a system and different compensators / controllers to control a plant.
3. Introduce students to the concept of state space analysis of control system.

Course Outcomes: Upon completion of this course, students will be able to:

1. Find the transfer function of a system represented by a block diagram and signal flow graph.
2. Evaluate the time domain specifications and steady state error of a system.
3. Investigate stability of the system using different tests.
4. Compare various controllers and compensators.
5. Apply State Space Concept to analyse and design a control system.

UNIT-I

*Control System Fundamentals:*Classification of control systems, Open and Closed Loop control systems,Block diagram reduction and signal flow graphs, Mathematical modelling of a Mechanical system and conversion into electrical System.

UNIT-II

*Time Response Analysis:*Transfer function and Impulse Response, Types of Inputs, Transient Response of first and second Order System with different inputs, Time domain Specifications. Types of Systems, static error coefficients, error series, PD, PI and PID controllers.

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UNIT-III

Routh-Hurwitz criteria for stability, Root Locus Techniques, Analysis of typical systems using root locus techniques, Effect of location of roots on system response.

UNIT-IV

*Frequency Response Analysis:*Frequency domain specifications,Bode plot, Principle of Argument, Nyquist plot and stability criterion, Gain and Phase Margins from the Bode and Nyquist diagrams. Lead and Lag compensators.

UNIT-V

State Space Analysis: Concept of State, StateVariable, State vector and State space. State space representations of linear time invariant systems, State transition matrix, Solution of state equation, Controllability,Observabilityand Design of control systems using state variable feedback.

Text Books:

1. I.J.NagrathandM.Gopal, "Control Systems Engineering", New Age International Publishers, 5/e 2012.
2. Benjamin C. Kuo, "Automatic Control Systems", 7/e, PHI, 2010.

Suggested Reading:

1. K. Ogata, "Modern Control Engineering", EEE, 5/e, PHI, 2003.
2. Richard C. Dorf and Robert H. Bishop, " Modern Control Systems", 11/e Pearson, 2008.
3. GopalMadan, "Digital control engineering" 1/e, New age publishers, 2008.

18EC C11

DIGITAL SYSTEM DESIGN

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge ofElectronic device concepts.

Course Objectives: This course aims to:

1. Learn various techniques for logic minimization.
2. Comprehend the concepts of various combinational circuits and sequential circuits.
3. Learn the Language fundamentals of Verilog HDL, also able to simulate and synthesizevarious digital modules.

Course Outcomes: Upon completion of this course, students will be able to:

1. The Various switching algebra theorems and minimization of switching functions.
2. The design and analysis of combinational logic circuits
3. Design and analysis of different types of flip-flops and sequential circuits including FSMs.
4. The Design of various combinational and sequential logic circuits using Verilog HDL.
5. The Simulation and synthesis of digital logic design using Verilog HDL.

UNIT-I

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Quine –McCluskey Tabular Minimization Method. Logic function realization: AND-OR, OR-AND and NAND/ NOR realizations.

UNIT-II

Introduction to Combinational Design: Binary Adders, Subtractors and BCD adder, Code converters Binary to Gray, Gray to Binary, BCD to excess3,BCD to Seven Segment display, Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Comparators Implementations of Logic Functions using Decoders and Multiplexers

UNIT-III

Sequential Logic Design:Latches,Flipflops,Difference between latch and flipflop, types of flipflops like S-R,D, T JK and Master-Slave JK FF, Edge triggered FF, flipflop conversions,set up and hold times, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Clock generation.

UNIT-IV

Introduction to HDLs: VLSI Design flow, Basic Concepts of Verilog HDL, Data Types, System Tasks and Compiler Directives. Gate Level Modelling: Gate Types and Gate Delays. Dataflow Modeling: Continuous Assignment and Delays. Design of Stimulus Block.

UNIT-V

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks. Switch level Modelling. Introduction to tasks and functions.Design of Mealy and Moore state models using Verilog HDL.Introduction to Logic Synthesis.Concept of Programming using FPGA.

Text Books:

1. Morris Mano M. and Michael D.Ciletti, "Digital Design, With an Introduction to Verilog HDL", 5th edition, Pearson 2013.
2. Samir Palnitkar, "Verilog HDL,A guide to Digital design and synthesis", 2/e , Pearson Education, 2008.

Suggested Reading:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Thomas L. Floyd, "Digital Fundamentals", Pearson, 11th edition, 2015.

18EG M01

INDIAN CONSTITUTION

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	Non credit

Course Objectives: This course aims to:

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indiannationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operativeSocieties.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right To Liberty.

UNIT-I

Constitution of India - Introduction and salient features .Constitutional history. Directive Principles of State Policy - Its importance and implementation.

UNIT-II

Union Government and its Administration - Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States. Parliamentary form of government in India. President: role, power and position.

UNIT-III

Emergency Provisions in India - National emergency, President rule, Financial emergency

UNIT-IV

Local Self Government - District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

UNIT-V

Scheme of The Fundamental Rights & Duties: Fundamental Duties - the legal status.
Scheme of The Fundamental Rights - To Equality, to certain Freedom Under Article 19, to Life And Personal Liberty Under Article 21.

Text Books:

1. The Constitution of India, 1950 (Bare Act), GovernmentPublication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition,2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis,2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

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18EE M01

INDIAN TRADITIONAL KNOWLEDGE

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	Non credit

Course Objectives: This course aims to:

1. Get a knowledge in Indian Culture
2. Know Indian Languages and Literature and the fine arts in India
3. Explore the Science and Scientists of Medieval and Modern India

Course Outcomes: Upon completion of this course, the student will be able to:

1. Understand philosophy of Indian culture
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras.

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II

Indian Languages, Culture and Literature:
Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.
Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV

Fine Arts in India (Art, Technology & Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music,

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Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT-V

Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. Kapil Kapoor, Text and Interpretation: The India Tradition,ISBN: 81246033375, 2005
2. Science in Samskrit, Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. S. Narain, Examinations in ancient India, Arya Book Depot, 1993
4. Satya Prakash, Founders of Sciences in Ancient India, Vijay Kumar Publisher, 1989
5. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Reading:

1. Kapil Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
2. Karan Singh, A Treasury of Indian Wisdom: An Anthology of Spiritual Learn, ISBN: 978-0143426158, 2016.

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18EC C12

ANALOG CIRCUITS LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge on Electronic Devices Lab and Electronic Workshop and Networks Lab.

Course Objectives: This course aims to:

1. Design and analysis of Biasing circuits and Power Amplifiers.
2. Know frequency response and behavior of various Single Stage, Multistage and Feedback amplifiers.
3. Generation of analog signals using Oscillators and Multi-vibrators

Course Outcomes: Upon completion of this course, students will be able to:

1. Define the bandwidth of single stage and multistage amplifiers using BJT and FET.
2. Compare and contrast different types of Multi-stage configurations, Feedback, Power amplifier.
3. Apply the concepts of analysis of BJT and compare the results in the lab for multi-vibrators, feedback, multistage amplifiers.
4. Categorize different types of feedback amplifiers, power amplifiers.
5. Choose the best configuration for the specifications (like conversion efficiency in power amplifiers, input and output impedance, resonating frequency and band-width).

Experiments

1. BJT and FET biasing circuits.
2. Design and frequency response of Common Emitter BJT amplifier.
3. Design and frequency response of Single stage and Multistage RC - Coupled amplifier using FET.
4. Voltage series feedback amplifier.
5. Voltage shunt feedback amplifier.
6. Current series feedback amplifier.
7. Current shunt feedback amplifier.
8. RC Phase Shift Oscillator.
9. Hartley Oscillator and Colpitts Oscillator.
10. Design of Class-B power amplifier.

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11. Design and development of Astablemultivibrator.
12. Design and development of Monostablemultivibrator.
13. Design and development of Schmitt Trigger.
14. Design and development of Voltage to Frequency converter.

Note: Wherever possible, Analysis and design of circuits should be carried out using SPICE tools.

Suggested Reading:

1. Robert Diffenderfer, "Electronic Devices Systems and Applications", Cengage Learning India Private Limited, 2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics, A Text - Lab Manual", 7th Edition, TMH 2001.

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18EC C13

ANALOG COMMUNICATION LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge on signal analysis and its representation is required.

Course Objectives: This course aims to:

1. Generate and detect various analog and pulse modulation schemes.
2. Develop and analyze the characteristics of PLL, Mixer and Pre-Emphasis & De-Emphasis circuits.
3. Estimate the power spectral density by analyzing the spectrum of a given signal.

Course Outcomes: Upon completion of this course, students will be able to:

1. Demonstrate the generation and detection of various analog modulatedsignals.
2. Understand the sampling concept and further they can generate and detect various pulse modulatedsignals.
3. Obtain and analyze frequency response of Pre-Emphasis and De-Emphasiscircuits
4. Understand Mixer, Radio receiver and PLLcharacteristics and also compare FDM and TDM.
5. Estimate the Power spectral density of noise and Signal to Noise ratio and further able to analyze spectrums of AMand FMsignals.

List of Experiments

1. AM signals generation anddetection.
2. Generation of DSB-SC using Balancedmodulator.
3. SSB Modulation and Demodulation.
4. FM generation anddetection.
5. Frequency response of Pre-Emphasis and De-Emphasiscircuits.
6. Evaluation of Radio Receivercharacteristics.
7. Sampling of continuous time signal and its Reconstruction(PAM).
8. Frequency division Multiplexing and De-Multiplexing.
9. Time division Multiplexing and De-Multiplexing.
10. PWM Modulation and Demodulation.
11. PPM Modulation and Demodulation.

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12. Determination of PLLCharacteristics.
13. Analysis of MixerCharacteristics.
14. Spectral Analysis of AM and FM signals using Spectral Analyzer.

Suggested Reading:

1. A.M. Zungeru, J.M. Chuma, M. Mangwala , L.K. Ketshabetswe, "Handbook of Laboratory Experiments in Electronics and Communication Engineering", Vol. 2, 1st Edition, Notion press, 2017.

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18EC C14

DIGITAL SYSTEM DESIGN LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Digital concepts and C language concepts.

Course Objectives: This course aims to:

1. Simulate and synthesize combinational logic circuits.
2. Simulate and synthesize sequential logic circuits.
3. Learn and implement procedure for any digital design.

Course Outcomes: Upon completion of this course, students will be able to:

1. Design a Digital circuit using Verilog HDL.
2. Understand various abstraction levels of a digital design.
3. Verify the functionality of a design using Test bench.
4. Simulate and synthesize combinational logic circuits.
5. Simulate and synthesize sequential logic circuits.

Write a Verilog HDL code to Simulate and synthesize the following in Gate level, Data flow and Behavioral Modeling styles.

1. Logic Gates.
2. Arithmetic Units: Adders and Subtractors.
3. Multiplexers and De-multiplexers.
4. Encoders, Decoders, Priority Encoder and Comparator.
5. Implementation of logic function using Multiplexers and Decoders.
6. Arithmetic and Logic Unit.
7. Flip-Flops.
8. Up, Down and UP/Down Counters.
9. Sequence Detector using Mealy and Moore type state machines.
10. Implementation of SSI Circuits using FPGA.

Suggested Reading:

1. Samir Palnitkar, "Verilog HDL,A guide to Digital design and synthesis", 2/e, Pearson Education, 2008.

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18ECC15

COMPUTER ARCHITECTURE AND MICROPROCESSORS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Basic knowledge on digital system design

Course Objectives:
This course aims to:
1. Study and understand the principles of computer system
2. Understand the design of computer system
3. Explore the architecture and instruction set of the microprocessors

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand how computer works.
2. Apply fixed and floating-point arithmetic algorithms.
3. Compare various memories, memory access techniques.
4. Assess the performance of computers.
5. Analyze architecture and instruction set of microprocessors.

UNIT-I
Data representation and Computer Arithmetic: Basic structure of computers, Functional units, Fixed point representation of numbers, Digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non-restoring algorithms, Floating point representation with IEEE standards.

UNIT-II
Basic Computer Organization and Design: Instruction codes, Stored program organization, Computer registers and computer instructions, Timing and control, hardwired and micro programmed control unit, Instruction cycle, Program interrupt, Interrupt cycle, Micro programmed Control organization, Address sequencing, Micro instruction format.

UNIT-III
Central Processing Unit: General register organization, Stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control, CISC and RISC: features and comparison, Instruction Pipeline.
Input-Output Organization: Peripheral devices, I/O interface: I/O Bus and interface modules, isolated versus memory mapped I/O.Modes of Transfer: Programmed I/O, DMA and Interrupt initiated I/O. Priority interrupt: Daisy chaining, Parallel Priority interrupt

UNIT-IV
Memory Organization: Memory hierarchy, Primary memory, Auxiliary memory, Associative memory, Cache memory, mapping functions: direct, associate and set associate, Virtual memory: address mapping using pages, Memory management.

UNIT-V
8086 Microprocessor: Evolution of microprocessors, 8086 Microprocessor: Internal architecture, flag register, Signal description under minimum and maximum mode of operation, register organization, Addressing modes.Overviewof Instruction set. Introduction to the advanced microprocessors (x86): Salient features, real and protected modes. Evolution of Pentium Processors.

Text Books:

1. MorrisMano.M., “Computer System Architecture”, 3/e, Pearson Education, 2005.
2. Hayes J.P, “Computer Architecture and Organization”, 3/e, McGraw Hill, 2012.
3. Barry B. Brey, “The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro, Pentium II, III, IV”, 8/e Pearson Education, 2006.

Suggested Reading:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, “Computer Organization” 5/e McGrawHill, 2011.
2. Ray A.K. and Bhurchandi, K.M., “Advanced Microprocessor and peripherals”, 2/e TMH 2007.
3. Douglas V Hall, SSSP Rao, “Microprocessors and Its Interfacing” (SIE), 3/e, Tata McGraw-Hill Education Pvt. Ltd, 2012.

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18EC C16

DIGITAL COMMUNICATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamentals of probability theory and analog communication systems is required.

Course Objectives:
This course aims to:

1. Make the student learn the different techniques involved in digital transmission of analog signals.
2. Give the student an understanding of the various concepts of information theory, source coding and Channel coding schemes.
3. Enable the student to interpret the performance of digital modulation schemes and learn various spread spectrum techniques.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Understand the concept of pulse digital modulation schemes and compare their performance.
2. Interpret the concept of information theory and apply source coding schemes.
3. Demonstrate various error control schemes and develop the encoding and decoding techniques to detect and correct the errors.
4. Analyze different digital modulation schemes and can compute the bit error performance.
5. Apply various spread spectrum modulation techniques.

UNIT-I Digital Transmission of Analog Signals: Elements of a digital communication system, Uniform quantization, PCM system, Bandwidth requirement of PCM system, Noise in PCM Systems, Non- uniform quantization, TDM-PCM system. Differential quantization, Differential PCM system, Delta Modulation, Noise in DM system, ADM. Comparison of PCM, DPCM, DM and DM schemes.

UNIT-II Information Theory: Uncertainty, Information and Entropy, Source coding: Source coding theorem, Shannon – Fano algorithm and Huffman coding. Discrete memory-less channels, Types of channels, cascaded channels, mutual information, Channel capacity, Information rate and Information capacity, Rate distortion theory.

UNIT-III Error Control Coding: Need for error control coding, Types of transmission errors. Linear Block Codes (LBC): description of LBC, generation, Syndrome and error detection, minimum distance of a block code, error detecting capabilities and error correcting, Hamming codes, Standard array and syndrome decoding. Binary cyclic codes (BCC): description of cyclic codes, encoding, decoding and error correction of cyclic codes using shift registers, Convolution codes: description, encoding, decoding: Exhaustive search method and sequential decoding.

UNIT-IV Digital Carrier Modulation Schemes: Optimum receiver for Binary Digital Modulation Schemes, Binary ASK, PSK, DPSK, FSK signaling schemes and their error probabilities. Introduction to MSK, Comparison of Digital Modulation Schemes. Introduction to M-ary Signaling Schemes: QPSK, Synchronization methods.

UNIT–V Spread-Spectrum Modulation: Need for spreading a code, generation and properties of PN sequence. Direct Sequence Spread Spectrum, Frequency Hopping spread spectrum systems and their applications.

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Text Books:

1. Sam Shanmugham.K., “Digital and Analog Communication Systems”, Wiley, 2012.
2. Simon Haykin, “Communication Systems”, 4/e, Wiley India, 2011.
3. Herbert Taub, Donald L. Shilling &GoutamSaha, “Principles of Communication Systems”, 4/e, Tata McGraw-Hill Education 2013.

Suggested Reading:

1. John Proakis, MassoudSalehi, “Digital Communications”, 5/e, McGrawHill Higher Education, 2007.
2. R.P. Singh, S.D. Sapre, “Communication Systems”, 2/e, Tata McGrawHill Education, 2008.
3. P.Ramakrishna Rao, “Digital Communication”, McGraw Hill Education, 2011.

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18EC C17

LINEAR AND DIGITAL INTEGRATED CIRCUITS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge about Analog electronic circuits.

Course Objectives:
This course aims to:
1. Impart the concepts of Op-Amp, 555 Timers, IC regulator, data converter and its characteristics.
2. Illustrate the linear and nonlinear applications of operational amplifier.
3. Design combinational and sequential circuits with IC, memories and PLD.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the basic construction, characteristics and parameters of Op-Amp.
2. Analyze the linear and nonlinear applications of Op-Amp.
3. Explain the concepts of IC555 timer, IC723 regulator, memories and PLD.
4. Classify and describe the characteristics of different logic families
5. Design logic functions of Combinational and Sequential circuits with ICs.

UNIT – I
Operational Amplifier: Op-Amp block diagram, ideal Op-Amp Characteristics, Inverting and Non-inverting amplifiers with ideal and non-ideal Op-amps, Voltage Follower, Op-Amp parameters: Input offset voltage, Output offset voltage, input offset and bias currents, Slew rate, CMRR and PSRR.

UNIT – II
Op-Amp Applications: Summing Amplifier, Difference Amplifier, ideal and practical Integrator and differentiator. Sample and hold circuit, Comparator, Schmitt Trigger with and without reference voltage, Triangular waveform generator.

UNIT – III
555 Timer: Functional diagram. Modes of operation: Monostable, Astablemulti-vibrators.
Voltage Regulator: IC7805, Analysis and design of regulators using IC 723.
Data Converters: Specifications, DAC- Weighted Resistor, R-2R Ladder, ADC-Parallel Comparator, Successive Approximation and Dual Slope.

UNIT – IV
Logic Families: Digital IC characteristics. TTL logic family, TTL series and TTL output configurations: open collector, Totem pole, Tri state logic. MOS logic family, CMOS logic family and its series characteristics, CMOS transmission gate, CMOS open drain and high impedance outputs. Comparison of TTL and CMOS logic families.

UNIT – V
Combinational and Sequential Circuits: Design of logic functions/circuits with: Decoder, Multiplexer, Adder: Serial adder, parallel adder and BCD adder, counters: asynchronous counter (7493/74293) and synchronous counter (74163/74193)
Semiconductor Memories: Memory Terminology, ROM, RAM types, Architectures, operation, FIFO memory, FIFO depth calculations, Expanding word size and capacity, Introduction to PLD's: PAL and PLA.

Text Books:

1. Ramakant A. Gayakwad, “Op-Amps and Linear Integrated Circuits”, 4/e, PHI, 2010.
2. Ronald J. Tocci, Neal S. Widmer& Gregory L.Moss, “Digital Systems: Principles and Applications”, PHI, 10/e, 2011.

Suggested Reading:

1. K.R.Botkar, “Integrated Circuits”, 10/e, Khanna Publishers, 2010.
2. Roy Chowdhury D, Jain S.B, “Linear Integrated Circuits”,4/e, New Age International Publishers, 2010.
3. Jain R.P., “Modern Digital Electronics”, 4/e, TMH, 2011.
4. Charles H Roth and Larry L Kinney, “Fundamentals of Logic Design” 7th edition, Cengage Publication, 2014.
5. David A. Bell, ‘Operational Amplifier and Linear ICs’, third edition, Oxford university press, 2013.

18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

To make the students to

1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

.

Course Outcomes:

At the end of the course, student will be able to understand

1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT - I

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills; Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT - II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT - III

Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT - IV

Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT - V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, “Management”, 10thEdition,Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, “Management”, 6/e., Pearson Education,2004.

Suggested Reading:

1. P.C. Tripathy& P.N. Reddy, “Principles of Management”, Tata McGraw Hill,1999
2. Harold Koontz and Cyril O’Donnell “Principles of Management’’, Tata McGraw Hill, 2017

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18EC E01

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

(Program Elective-I)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamental concepts of Network Theory and Electronic Circuits.

Course Objectives:

This course aims to:

1. Explain basic concepts, definitions and error analysis in measurement.
2. Identify the details of instrumentation and devices intended for a particular application.
3. Elaborate discussion about the importance of signal display devices and analyzers in measurement and describe the various bridge configurations and their applications.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Define the characteristics and analyze the errors of measurement systems.
2. Select the appropriate passive or active transducers for measurement of physical phenomenon.
3. Relate and apply the appropriate measuring techniques to real time applications.
4. Interpret the usage of DVM, Spectrum Analyzer and DSO instruments for appropriate measurements.
5. Develop an understanding of construction and working of different AC and DC bridges and their applications.

UNIT– I

Error - Absolute error, Relative error and Accuracy, Precision - conformity and significant figures, limiting errors, Propagation of errors, Errors in measurement-gross, systematic and random errors, Loading effect, Statistical analysis of measurement data and probable error, Resolution, Sensitivity, Calibration.

UNIT – II

Classification of transducers, Strain gauges - gauge factor, bonded, un-bonded and semiconductor stain gauges, rosettes, LVDT - principle, construction and displacement measurement, Capacitive transducer - principle and thicknessmeasurement, Piezo-electric transducer and different modes of operation, Photo- electric transducers.

UNIT – III

Characteristics, pressure, power and intensity levels of sound, Microphones, Temperature measurement - resistance wire thermometers, semiconductor thermometers and thermocouples.

UNIT – IV

DVMs- ramp, dual-slope integration, integrating and successive-approximation types, digit, resolution, sensitivity and general specifications, Spectrum analyzers, Digital storage oscilloscope, Introduction to Virtual Instrumentation (LabView).

UNIT – V

Introduction to Bridges, DC Bridges - Wheatstone's bridge, Kelvin's bridge, AC bridges - introduction, general balance equation for four arm bridge, capacitance comparison bridge, inductance comparison bridge, Maxwell's bridge, Wien's bridge, Wagner's earth connection.

Text Books:

1. Albert D. Helfric, and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 2010.
2. D V S Murthy, "Transducers and Instrumentation", 2nd Edition, PHI, 2013.
3. Nakra B.C, and Chaudhry K.K., "Instrumentation, Measurement and Analysis", 3rdEdition, TMH, 2013.

Suggested Reading:

1. David A. Bell, “Electronic Instrumentation and Measurements”, 2nd Edition, PHI, 2003.
2. H S Kalsi, “Electronic Instrumentation”, 3rdEdition, TMH, 2011.
3. A.K.Sawhney, “Electrical & Electronic Measurement and Instruments”, DhanpatRai& Co. Publications, 2005.

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18EC E03

OPTICAL COMMUNICATION

(Program Elective-I)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamentals of Electromagnetic theory and Communication isrequired.

Course Objectives:

This course aims to:

1. Understand the properties of optical fiber that affect the performance of a communication link and types of fiber materials with their properties and the losses occur in fibers and the principles of single and multi-mode optical fibers and their characteristics.
2. Know working of semiconductor lasers, and differentiate between direct modulation and external electro-optic modulation.
3. Analyze the operation of LEDs, laser diodes, and PIN photo detectors (spectral properties, bandwidth, and circuits) and apply in optical systems.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Select necessary components required in modern optical communications systems.
2. Analyze various distortions in optical fibers.
3. Distinguish the various Optical sources and fiber optical receivers.
4. Examine the Power Launching and coupling, Lensing schemes.
5. Determine the performance of optical communication link.

UNIT–I

Overview of Optical Fiber Communication: The general system, advantages ofoptical fiber communications. Optical fiber wave guides- Acceptance angle, Numerical Aperture, Skew rays, Cylindrical fibers: Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers: Cut off wavelength, Mode Field Diameter, Effective Refractive Index.

UNIT–II

Signal Distortion in Optical Fibers: Attenuation, Absorption, Scattering andBending losses, Core and Cladding losses, Information capacity determination,Group delay, Types of Dispersion: Material dispersion, Wave-guide dispersion, Polarization, Mode dispersion, Intermodal dispersion, Pulse broadening in Graded index fiber.

Optical Fiber Connectors: Connector types, Single mode fiber connectors,

Connector return loss, Fiber Splicing: Splicing techniques, Splicing single mode fibers, Fiber alignment and joint loss: Multimode fiber joints, single mode fiber joints.

UNIT–III

Optical Sources: LEDs, Structures, Materials, Quantum efficiency, PowerModulation, Power bandwidth product. Injection Laser Diodes: Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies, Optical detectors: Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors.

UNIT–IV

Source to Fiber Power Launching: Power coupling, Power launching,Fundamental receiver operation, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantum limit.

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UNIT–V

Optical System Design: Point-to- point links, Component choice andconsiderations, Link power budget, Rise time budget with examples, WDM, Necessity, Principles, Measurement of Attenuation and Dispersion.

Text Books:

1. Gerd Keiser, “Optical Fiber Communications”, McGraw-Hill International edition, 3rd Edition, 2000.
2. John M. Senior, “Optical Fiber Communications”, PHI, 2nd Edition, 2002.
3. D.K. Mynbaev, S.C. Gupta and Lowell L. Scheiner, “Fiber Optic Communications”, Pearson Education,2005.

Suggested Reading:

1. S.C.Gupta, “Text Book on Optical Fiber Communication and its Applications”, PHI, 2005.
2. Govind P. Agarwal, “Fiber Optic Communication Systems”, John Wiley, 3rd Edition, 2004.
3. Joseph C. Palais, “Fiber Optic Communications”, 4th Edition, Pearson Education, 2004.

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18ECE04

TELECOMMUNICATION SWITCHING SYSTEMS

(Program Elective-I)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge on communication systems is required.

Course Objectives:
This course aims to:
1. Understand basic concepts of switching and signalling.
2. Solve problems and design simple systems related to tele-traffic and trunking efficiency.
3. Analyse the switching systems like Space division switching, Time division switching, circuit switching, Packet switching and Cell relay (ATM).

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the fundamental concepts of various signaling and switching involved in telecommunication switching systems.
2. Elaborate the basic principle of time and space division switching in telecommunication networks.
3. Design the multistage switch by inclusion of space and time switching techniques.
4. Analyze the performance comparison of Control signaling schemes in circuit switching systems.
5. Evaluate the performance of packet switching and cell relay.

UNIT-I
Introduction:
Introduction to telephone communication, manual switching system, Automatic Strowger switching system, crossbar switching system, Signalling in Automatic Strowger Switching System, Elements of a Switching System, Design parameters of Switching System.

UNIT- II
Electronic Space and Time Division Switching:
Stored program control; centralized and distributed, software architecture, application software, enhanced services; Basic time division space switching, basic time division time switching, time multiplexed space switching, time multiplexed time switching, combination switching, multistage combination switching.

UNIT-III
Elements of Tele-Traffic:
Network traffic, Load and parameters, grade of service, Trunking Efficiency and blocking probability, modelling switching systems, incoming traffic and service time characterization, blocking models and loss estimates, delay systems.

UNIT-IV
Circuit Switching and Signalling:
Circuit Switching concepts, Circuit Switch Elements, Three Stage Blocking Type Space Division Switch**;** Control Signalling Functions, In Channel Signalling, Common Channel Signalling, Features of Signalling System Number7 (SS7).

UNIT-V

Packet Switching and Cell Relay:

Packet Switching, Datagram and Virtual Circuit switching Principles, Effects of variable packet size; ATM, features of ATM, Quality of Service in ATM.

Text books:

1. J E Flood, “Telecommunication switching traffic and networks” Pearson education, 2002.
2. William Stallings, “Data and Computer Communications”, Ninth Edition, Pearson Prentice Hall, 2011.

Suggested Reading:

1. ThiagarajanVishwanathan,“Telecommunication Switching Systems and Networks”, PHI,2nd Edition,2015.
2. Behrouz A. Forouzan, “Data Communications and Networking”, 4thEdition, Tata McGraw Hill, 2007.
3. Roger L. Freeman, “Fundamentals of Telecommunications”,2nd Edition, Wiley-IEEE Press-2005.

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18CS O05

FUNDAMENTALS OF VIRTUAL REALITY

(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. To introduce hardware and software components of virtual reality.
2. To provide knowledge about geometry of virtual worlds.
3. To understand visual physiology, perception and audio in VR.
4. To study the applications of VR in various domains like military and robotics.

Course Outcomes:

Upon completion of this course, the student will be able to:

1. Define Virtual Reality and describe the components of a VR system
2. Apply geometric modeling and transformation techniques to model real world scenarios
3. Use visual physiology, visual perception and audio for developing interfaces
4. Analyse tracking and rendering for building VR systems
5. Evaluate virtual reality systems for usability
6. Illustrate the applications of VR systems in Medical, Military and Robotics domains

UNIT - I

Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. **Input Devices:** Trackers, Navigation and Gesture Interfaces: Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces.

Output Devices: Graphics displays, sound displays and haptic feedback.

UNIT - II

Geometry of Virtual Worlds: Geometric modeling, transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, Axis-angle representations, Quaternions, Converting and multiplying rotations, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Canonical view transform, Viewport transform.

UNIT - III

Light and Optics: Three interpretations of light, Refraction, Simple lenses, Diopters, Imaging properties of lenses, Lens aberrations, Optical system of eyes.

Visual Physiology: Photoreceptors, Sufficient resolution for VR, Light intensity, Eye movements, Eye movement issues for VR, Neuroscience of vision,

Visual Perception: Depth perception, Motion perception, Frame rates and displays.

UNIT - IV

Tracking Systems: Overview, Orientation tracking, Tilt drift correction, Yaw drift correction, Tracking with a camera, Perspective n-point problem, Filtering, Lighthouse approach

Visual Rendering: Overview, Shading models, Rasterization, Pixel shading, VR-specific problems, Distortion shading, Post-rendering image warp.

UNIT – V

Audio: Physics and physiology, Auditory perception, Auditory localization, Rendering, Spatialization and display, Combining other senses.

Interfaces: overview, Locomotion, Manipulation, System control, Social interaction, Evaluation of VR Systems.

Applications: Medical, Military, Robotics.

Text Books:

1. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007
2. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

Suggested Reading:

1. George Mather, Foundations of Sensation and Perception: Psychology Press; 2nd edition, 2009.
2. Peter Shirley, Michael Ashikhmin, and Steve Marschner, Fundamentals of Computer Graphics, A K Peters/CRC Press; 3rd edition, 2009.
3. K. S. Hale and K. M. Stanney, Handbook on Virtual Environments, 2ndedition, CRC Press, 2015.

Online Resources:

1. http://msl.cs.uiuc.edu/vr/
2. https://nptel.ac.in/courses/106106139/

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18ITO01

OBJECT ORIENTED PROGRAMMING USING JAVA

(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. To familiarize with fundamentals of object-oriented programming paradigm.
2. To impart the knowledge of string handling, interfaces, packages and inner classes.
3. To facilitate learning Exception handling and Multithreading mechanisms.
4. To gain knowledge on collection framework, stream classes.
5. To familiarize with event driven GUI programming and Database connectivity.

Course Outcomes:

Upon completing this course, students will be able to:

1. Understand the concepts of Object-Oriented Programming and class concept in Java.
2. Apply concepts of OOP such as Inheritance, Interfaces, Packages and Inner classes.
3. Handle exceptions and demonstrate the concepts of Multithreading and Generic classes.
4. Develop programs using Java Collection API and Stream classes.
5. Design and Develop GUI applications with JDBC.

UNIT-I

OOP concepts: Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, Procedural and object-oriented programming paradigms.

Introduction to Java: Java's Magic: The Byte code, The Java Buzzwords, Simple Java Programs, Java Primitive Types, Arrays: How to create and define arrays, Basic Operators, Control statements.

Introducing Classes: Declaring objects, methods, Constructors, this keyword, Method Overloading and Constructor Overloading, Objects as parameters, Returning objects, Use of static and final keywords.

UNIT-II

Inheritance: super and subclasses,Member access rules, super keyword, Method overriding, Dynamic method dispatch,Abstract classes, using final with inheritance, Introduction to Object class.

Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

Interfaces: Defining andimplementing interfaces, Nested Interfaces.

Strings Handling: String &StringBuffer classes, StringTokenizer class and Wrapper classes and conversion between Objects and primitives.

Inner classes in Java: Types of inner classes, Creating static / non-static inner classes, Local and anonymous inner classes.

UNIT-III

Exception Handling in Java: what areExceptions? Exception types, Usage of try, catch, throw, throws and finally clauses, writing your own exception classes.

Multi-threading in Java: The java Thread Model, How to create threads, Thread class in java, Thread priorities, Thread synchronization.

Generics: What are Generics? Generic classes, bounded types, Generic methods and interfaces.

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UNIT-IV

Collections Framework: Overview of Collection Framework, commonly used Collection classes – ArrayList, LinkedList, HashSet, LinkedHashSet, TreeSet, Collection Interfaces –Collection, List, Set, SortedSet, accessing a collection via an Iteration,storing user-defined classes in collections, Map Interfaces and Classes, Using a comparator. Legacy classes – Vector, Hashtable, The Enumeration interface.

Input/Output: How to read user input (from keyboard) using scanner class,Stream classes, InputStream, OutputStream, FileInputStream, FileOutputStream, Reader and Writer, FileReader, FileWriter classes. File class.

UNIT-V

GUI Design and Event Handling: Component, Container, window, Frame classes. Working with Frame window GUI Controls, Layout Managers, Introduction to Swings, Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces, Handling button click events, Adapter classes. Writing GUI Based applications.

Database Handling in Java: Java Database Connectivity (JDBC) using MySQL.

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", 8th Edition, Tata McGraw Hill Publications, 2011.
2. Cay S. Horstmann, Gary Cornell, "Core Java, Volume I, Fundamentals", 8th Edition, Prentice Hall, 2008.

Suggested Reading:

1. Sachin Malhotra & Saurabh Choudhary, "Programming in Java", 2nd Edition, Oxford University Press, 2014.
2. C. Thomas Wu, "An introduction to Object-oriented programming with Java", 4th Edition, Tata McGraw-Hill Publishing company Ltd., 2010.
3. Kathy Sierra, Bert Bates, "Head First Java: A Brain-Friendly Guide" 2nd Edition, O'Reilly,2005

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html.
2. http://nptel.ac.in/courses/106106147/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

18MT O04

QUANTUM COMPUTING

(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of Number theory and cryptography

Course Objectives:

This course aims to:

1. To translate fluently between the major mathematical representations and its quantum operations,
2. To implement' basic quantum algorithms
3. To explain quantum decoherence in systems for computation
4. To discuss the physical basis of uniquely quantum phenomena.

Course Outcomes:

Upon completion of this course, the student will be able to:

1. Identify the working of a Quantum Computing Program, its architecture and program model.
2. Compute basic mathematical operations.
3. Demonstrate quantum logic gate circuits.
4. Develop quantum algorithm.
5. Appraise quantum algorithm on major toolkits

UNIT-I

Introduction to Quantum Computing:

Motivation for Studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc), Origin of Quantum Computing, Overview of major concepts in Quantum Commuting (Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement)

UNIT-II

Math Foundation for Quantum Computing:

Matrix Algebra: Basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen Vectors.

UNIT-III

Building Blocks for Quantum Program:

Architecture of a Quantum Computing Platform, Details of q-bit system of information representation (Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from Quantum algorithmic perceptive e.g.Bell State,

UNIT-IV

Quantum Logic Gates and Circuits:

Quantum Logic gates and Circuit: Pauli, Hadamard, Phase shift, controlled gates, ising, Deutsch,Swap etc.), Programming model for a Quantum Computing program (Steps performed on classical computer, steps performed on Quantum Computer, Moving data between bits and qubits)

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UNIT-V

Quantum Algorithms:

Basic techniques exploited by quantum algorithms (Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum walks), Major Algorithms (Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm), OSS Toolkits for implementing Quantum program (IBM quantum experience, Microsoft Q, RigettiPyQuil (QPU/QVM))

Text Books:

1. Michael A.Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quanturm Computing Explained", Wiley

18EC C18 DIGITAL COMMUNICATION LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge about analog communication is required.

Course Objectives:
This course aims to:
1. Carry out experiments on various pulse digital modulation techniques.
2. Conduct the experiment to identify errors in cyclic codes
3. Work on convolutional encoder and decoder for controlling the errors.

Course outcomes:
Upon completing this course, students will be able to:
1. Demonstrate various pulse digital modulation techniques.
2. Assess different line coding techniques.
3. Detect and correct errors in cyclic codes.
4. Examine the errors in convolutional encoder and decoder.
5. Evaluate various digital carrier modulation techniques experimentally.

List of Experiments:

1. PCM generation and detection.
2. Data formats / Line coding techniques.
3. Linear Delta Modulation and demodulation.
4. Adaptive Delta Modulation and demodulation.
5. Error detection and correction in cyclic codes.
6. Convolutional encoder and decoder.
7. ASK generation and detection.
8. FSK generation and detection.
9. BPSK generation and detection.
10. QPSK generation and detection.
11. MSK generation and detection.
12. Structured Enquiry:
    - Design N-bit PCM encoder based on the given specifications.
13. Open ended Enquiry:
    - Develop a code for different digital modulation schemes and verify through simulation.
    - Design different Line coding schemes using logic Gates.

Suggested Reading:

1. A.M. Zungeru, J.M. Chuma, M. Mangwala , L.K. Ketshabetswe, "Handbook of Laboratory Experiments in Electronics and Communication Engineering", Vol. 2, 1st Edition, Notion press, 2017.

18EC C19

LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Knowledge of Analog electronic circuits.

Course Objectives:
This course aims to:
1. Know and verify the concepts of 741 Op-Amp, IC555 timer, IC723 and data converters.
2. Know the various characteristics of TTL and CMOS gates and implement the circuits with Digital ICs.
3. Contrast the differences between linear and digital ICs.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Analyze the configurations, parameters of Op-Amp (IC741).
2. Demonstrate the circuits of Op-Amp for various applications.
3. Design the circuits using IC555 timer, IC723 and data converters.
4. Determine the characteristics of TTL and CMOS gates
5. Develop various combinational circuits and sequential circuits using digital ICs.

Lab Experiments

Part-A: Linear IC Experiments
1. Voltage Follower, Inverting and Non-Inverting Amplifiers using OpAmp.
2. Measurement of Op-Amp parameters
3. Arithmetic Circuits using Op-Amp
4. Waveform generation using Op-Amp.
5. Astable and Monostable multi vibrators using IC555Timer.
6. Low and High Voltage Regulators using IC723.
7. D to A Converter using R-2R ladder.

Part-B: Digital IC Experiments
1. Measurement of various characteristic parameters of TTL and CMOS gates.
2. Logic function Implementations using Decoders.
3. Logic function Implementations using Multiplexers
4. Binary adder and subtractor, BCD adders using ICs.
5. Design of Synchronous, Asynchronous up/down counters.
6. Shift registers and ring counter using ICs.
7. Interfacing counters with 7-segment LED display units.
8. Structured enquiry: Implement a Security Monitoring System(Use only nonprogrammable ICs.)
9. Open ended enquiry: Design a Digital Clock structure to display minutes and seconds. (Use only nonprogrammable Ics.)

Mini Project cum Design Exercise(s):

To realize and design a Mini project using either linear or digital or combination of linear and digital IC's

Sample Mini Projects:

a. Design and implementation of Binary Multiplier
b. Design and implementation of a Water level indicator using 555 IC
c. Design and implementation of FSK Modulator using 555 IC.
d. Design a circuit to generate a one pulse per second signal from 1 KHz square wave.

Suggested Reading:

1. National Semiconductor Corporation, "Linear applications", Data book, 1986.
2. National Semiconductor Corporation, "Logic data book-Vol-II", 1984.

18EC C20

DIGITAL SIGNAL PROCESSING

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Concepts of Signals, Systems and Filter designing.

Course Objectives:
This course aims to:
1. Know Discrete-time signals in the frequency domain using DFT and FFT.
2. Design digital IIR and FIR filters for the given specifications.
3. Introduce the basics of Multirate digital signal processing, Digital signal processor and its applications

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the concept of DFT and FFT for signal processing applications.
2. Design FIR filters for the given specifications.
3. Implementation of IIR filters for the given specifications.
4. Interpret the concepts of Multirate digital signal processing and its applications.
5. Explain the architecture features of TMS320C67XX processor.

UNIT-I
Discrete Fourier Transform: Introduction, Discrete Fourier Transform (DFT), Properties of DFT, Efficient computation of DFT-Fast Fourier Transform (FFT) algorithms: Radix-2 FFT algorithms – Decimation in Time, Decimation in Frequency algorithms, Inplace computation, Bit reversal algorithm, Linear filtering using FFT algorithm.

UNIT-II
FIR Filter Design: Amplitude and Phase responses of FIR filters – Linear phase FIR filters – Windowing technique for design of FIR filters – Rectangular, Bartlet, Hamming, Blackman, and Kaiser Windows. Realization of digital filters-Direct form-I and II of IIR filters, Realization of linear phase FIR filter, Finite word length effects.

UNIT-III
IIR Filter Design: Butterworth and Chebyshev approximation, IIR digital filter design techniques- Impulse Invariant transformation, Bilinear transform techniques, Digital Butterworth and Chebyshev filters, Spectral transformation techniques. Comparison between FIR and IIR filters.

UNIT- IV
Multirate Digital Signal Processing: Introduction -Decimation by a Factor -D, Interpolation by a Factor -I, Sampling Rate Conversion by a Rational Factor -I/D, Nobel identities, Applications of Multirate Signal Processing: Phase shifters, QMF filter banks, Narrowband filters and sub band coding of speech signal.

UNIT-V
DSP Processors: Introduction, Difference between DSP and General-Purpose Processor architectures, need for DSP processors. General purpose DSP processor- TMS320C67XX processor, architecture, functional units, pipelining, registers, linear and circular addressing modes, instruction set.

Text Books:

1. Alan V. Oppenheim & Ronald W. Schafer, "Digital Signal Processing", PHI, 2/e, 2010.
2. John G. Proakis&Dimtris G. Manolakis, "Digital Signal Processing Principles, Algorithms and Application", PHI, 4/e, 2012.
3. RulphChassaing, "Digital Signal Processing and Applications with the C6713 and C6416 DSK", John wiley& sons, 2005.

Suggested Reading:

1. Sanjit K Mitra, "Digital Signal Processing, A computer-based approach", TMH, 3/e, 2011.
2. TarunKumarRawat, "Digital Signal Processing", 1stedition, Oxford, 2015.
3. Avtar Singh & S. Srinivasan, "Digital Signal Processing Implementation using DSP microprocessors", Thomson Brooks, 2/e, 2004.
4. Chi- Tsong Chen, "Digital Signal Processing Spectral Computation and filter Design", Oxford, 2/e, 2007.

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18ECC21

MICROCONTROLLERS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of Computer Architecture and Microprocessors.

Course Objectives:
This course aims to:
1. Understand architecture features of the microcontrollers
2. Learn the programming of the microcontrollers
3. Understand interfacing of various modules with microcontrollers.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Acquire an overview of how a processor and a controller are distinguished.
2. Understand the architectures of different microcontrollers to enable to design applications using them.
3. Develop code both in assembly and in high level language for various applications of microcontrollers.
4. Analyze and design real world applications by using on/off chip peripherals of different microcontrollers.
5. Apply theoretical learning to practical real time problems for automation.

UNIT-I
8051Microcontroller: Introduction to Microcontroller, Overview of 8051 family, Internal Architecture of 8051, PSW, Pin description, I/O Ports, Memory organization and expansion. Addressing modes and Bit addressable features, 8051 Instruction set: Data transfer, Arithmetic, Logical, Program branching and bit manipulation instructions.

UNIT-II
8051 Programming: Introduction to 8051 programming development tools, basic programming using instruction set, Introduction to 8051 C Programming, SFRs, 8051 Timer Programming in Assembly and C, 8051 Serial port Programming in Assembly and C, 8051 Interrupt Programming in Assembly and C.

UNIT-III
8051 Interfacing: 8051 interfacing to external memory (RAM, ROM), 8255 PPI interfacing, LCD and Keyboard interfacing, Digital to Analog converter, Analog to Digital converter and Sensor interfacing, Relay and PWM, DC Motor interfacing, Stepper Motor interfacing

UNIT-IV
ARM: Introduction to RISC Processors, ARM Design Philosophy, ARM Processor families, Architecture- Revisions, Registers, Program status register, Pipeline, Introduction to Exceptions,
ARM Instruction set: Data processing instructions, Branch instructions, Load-Store instructions, Software interrupt instruction, Program Status Register instructions, Loading constants, and Conditional executions. Introduction to THUMB instructions: Differences between Thumb and ARM modes, Register usage.

UNIT-V
ARM 7 Microcontroller (LPC2148)**:** Salient features of LPC 2148, Pin description of 2148, Architectural Overview.
ARM 7(LPC2148) **Peripherals:** Description of General-PurposeInput/output (GPIO) ports, Pin control Block. Features, Pin description, Register description and operation of PLL, Timers, PWM, ADC, DAC. Communication protocols: Brief overview on I2C, SPI, and CAN.

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Text Books:

1. Mazidi M.A, Mazidi JG &Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C", 2/e, Pearson Education, 2007.
2. Andrew N.Sloss, DomonicSymes, Chris Wright, "ARM System Developers Guide Designing and Optimizing system software", 1/e, Elsever, 2004.

Suggested Reading:

1. Ayala K.J, "The 8051 Microcontroller Architecture, Programming and Applications", Penram International, 2007.
2. Steve Furber, "ARM System on Chip Architecture", 2/e, Pearson education, 2000.
3. Philips semiconductors, "ARM 7 (LPC 214x)user manual", 2005.
4. Lyla B. Das, "Architecture, Programming and Interfacing of Low-power Processors-ARM 7, Cortex-M", CENGAGE, 2017.

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18ECC22

MICROWAVE AND RADAR ENGINEERING

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
This course aims to:
1. To understand the importance of microwaves and their applications.
2. To understand the principle and operation of microwave sources.
3. To understand principle and operation of different radar systems.

Course Outcomes:
Upon completing this course, students will be able to:
1. Apply the wave equations and their solutions to analyze the waves in the waveguides.
2. Determine the scattering matrix for various microwave components.
3. Analyze the interaction of electron beam and RF field for various microwave sources.
4. Examine the principles of operation of pulse, CW and MTI radar system.
5. Compare different types of tracking radars.

Unit-I
Introduction to Microwaves: Microwave frequency spectrum, Advantages and Applications of Microwaves.
Rectangular Waveguides: Rectangular waveguides, TM and TE waves, Impossibility of TEM wave in waveguides. Wave Impedance.
Circular Waveguides: Solution of wave equations in cylindrical coordinates, Characteristics of TM and TE modes.
Microwave Cavities: Rectangular and Circular Cavity Resonators, Quality factor and applications of cavity resonators.

Unit-II
Microwave Circuits and Components: Concept of microwave hybrid circuit, Introduction to scattering parameters. Properties and S-parameters of reciprocal components – E and H Plane Tees, Magic Tee, Directional Coupler.
Non-Reciprocal Components: Ferrites – Composition and Faraday Rotation; Ferrite Components – Isolators, Gyrators and Circulators. S- Parameters of Isolator and Circulator.

Unit-III
Microwave Tubes: Limitations of Conventional Tubes at Microwave Frequencies. Principles of Gunn Diode.
O-type tubes: Two cavity klystron, velocity modulation process, bunching process. Output power and efficiency. Reflex Klystron-Velocity Modulation, Power out and efficiency, Electronic admittance.
Helix TWT: Slow Wave Structures, Principles of Operation and Applications of TWT (qualitative treatment only).
M-type Tubes: Introduction, Magnetron Oscillators, different types, π-mode of operation, frequency pushing and pulling effects and their remedies.

Unit- IV
Radar Systems: Introduction to radar, radar block diagram and operation, radar frequencies, Applications of radar, Prediction of range performance, minimum detectable signal, receiver noise, probability density function, SNR, Integration of radar pulses, radar cross-section of targets, PRF and range ambiguities, transmitter power, system losses.

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Unit-V

Radar Types: Doppler effect, CW radar, FM CW radar, multiple frequency CW radar. MTI radar, delay line canceller, range gated MTI radar, blind speeds, staggered PRF.

Tracking radar: Sequential lobbing, Conical scan, Monopulse: Amplitude comparison and Phase comparison methods.

Text Book:

1. Samuel Y. Liao, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
2. Merril. I. Skolnik, "Introduction to Radar Systems", 2/e, MGH, 2001.

Suggested Readings:

1. Rizzi P, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
2. Annapurna Das and Sisir K Das "Microwave Engineering" 1/e, 2000, Tata McGraw-Hill.
3. Herbert J.Reich, John G.Skalnik, Philip F. Ordung, Herbert L. Krauss," Microwave Principles", East-West Pvt. Ltd. Madras.

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18EC E06

MOBILE CELLULAR COMMUNICATION

(Program Elective-II**)**

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Basic course on Analog Communication, Digital Communication,Antenna and Wave propagation.

Course Objectives:
This course aims to:
1. Understanding of Cellular mobile architecture and key concepts like interference and handoff.
2. Know the effects of multipath and Doppler on wireless channel performance in terms of fading.
3. Study the use of Modulation and Multiple access techniques in GSM and CDMA mobile cellular systems

Course Outcomes:
Upon completion of this course, students will be able to:
1. Choose an appropriate concept, Propagation model and multiple access technique to improve the capacity
2. Demonstrate various technologies and their specifications for mobile communication.
3. Distinguish the system architecture of Mobile Communication Systems.
4. Estimate path loss of fading channel and performance measures of antenna and receiver.
5. Compare the technology trends changing from generation to generation

UNIT-I
Cellular Concepts: Cell structure, frequency reuse, cell splitting, channelassignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 4G and 5G cellular standards. Signal propagation-Propagation mechanisms, large scale signal propagation and log-normal shadowing.

UNIT-II
Fading Channels: Multipath and small-scale fading, Doppler shift, statisticalmultipath channel models, narrowband and wideband fading models, power delay profile, average and RMS delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate. Capacity of flat and frequency selective channels.

UNIT-III
Antennas: Antennas for mobile terminal- monopole antennas, PIFA, base stationantennas and arrays. Multiple access schemes: FDMA, TDMA, CDMA and SDMA. Modulation schemes QAM and GMSK; multicarrier modulation -OFDM.

UNIT-IV
Receiver Structure: Diversity receivers- selection and MRC receivers, RAKEreceiver, MIMO and space time signal processing, spatial multiplexing, diversity/ multiplexing. Trade off, Performance measures Outage, average SNR, average symbol/bit error rate.

UNIT-V
Mobile Cellular System Examples: GSM, EDGE, GPRS, IS-95, CDMA 2000 andWCDMA. Comparison of system specifications

Text Books:

1. Rappaport Theodore S, “Wireless Communications Principles and Practice”, 2nd Edition, 2002.
2. William C.Y.Lee, “Mobile Cellular Telecommunications: Analog and Digital Systems”, 2/e, Mc-Graw Hill, 2011.
3. Raymond Steele, “Mobile Radio Communications”, IEEE Press, New York, 1992.

Suggested Reading:

1. AJ Viterbi, “Principles of Spread Spectrum Communications”, Addison Wesley, 1995.
2. VK Garg& JE Wilkes, “Wireless & Personal Communication Systems”, Prentice Hall, 1996.
3. T.L.Singhal, “Wireless Communication Systems”, 1/e, TMH Publications, 2010.
4. Kernilo, Feher, “Wireless Digital Communications”, PHI, 2002.

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18EC E07

PRINCIPLES AND APPLICATIONS OF AI

(Program Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of probability, Linear Algebra, Data Structure and programming.

Course Objectives:
This course aims to:

1. Exposure to the foundation of Artificial Intelligence.
2. Familiarize the applications of Artificial Intelligence in Industry
3. Inculcate the concepts of Neural Networks and Pattern Recognition

Course Outcomes:
Upon completion of the course, students will be able to:

1. Understand the basics of AI and intelligent agents.
2. Apply Expert Systems to solve real time problems
3. Understand knowledge representation methods.
4. Build algorithms using Clustering techniques for various applications
5. Solve the various classification problems like object recognition

UNIT-I

Introduction to AI and Intelligent Agents: Concept of AI, current status of AI, Agents, Good Behavior: Environment, problem formulation. The structure of agents. Basic concepts of Search Algorithms.

UNIT-II

Knowledge representation: Bayesiannetwork representation, Construction and inference**.** Hidden Markov Model. Approaches to knowledge representation, knowledge representation using the semantic network, extended semantic networks for Knowledge representation, knowledge representation using frames.

UNIT-III

Neural Networks: What is a neural network, the human brain, models of a neuron, neural networks as a directed graph, feedback and network architectures. Learning processes and learning tasks.

UNIT-IV

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, Rule-based expert systems, blackboard systems truth maintenance systems and application of expert systems.

UNIT-V

Applications and tools of Artificial Intelligence: Pre-processing, time series prediction and feature extraction. Principle Component Analysis. **Statistical Pattern Recognition:** Object recognition, Classification and regression, Concepts of Associative memories and optimization. Application of AI in speech, Image processing and IOT.

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Text Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence—A Modern Approach", 3rd Edition, Prentice-Hall Series, 2010.
2. Christopher M. Bishop, Clareddon, "Neural networks for pattern Recognition", Oxford, 1995.
3. Simon Haykin, "Neural networks and learning Machines", 3rd Edition, Pearson- Prentice Hall, 2009.
4. M. Narsimhamurty and V. Susheela Devi, "Pattern Recognition- An Algorithmic Approach", Springer Universities Press, 2011
5. B. Yegnanarayana, "Artificial Neural Networks", PHI, 2005.

Suggested Books:

1. Elaine Rich, Kevin Knight and Shivashankar B Nair, "Artificial Intelligence", Tata McGraw Hill Education Pvt. Ltd., 2010.
2. Flasiński, Marius, "Introduction to Artificial Intelligence", Springer International Publisher, 2016.

18ECE11

CPLD AND FPGA ARCHITECTURES

(Program Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Digital logic design and digital integrated circuits.

Course Objectives:
This course aims to:
1. Study various PLD, CPLDs and FPGA Architectures and its features.
2. Understand the different programming technologies, placement and routing.
3. Study the design tools for FPGA and ASICs.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Recall the fundamental concepts of Digital logic circuits and PLDs
2. Compare the performance of the various types of PLDs
3. Understand the architecture and design aspects of various CPLDs and FPGAs
4. Implement the various logic functions using PLDs and FPGAs
5. Demonstrate the VLSI tool flow for CPLD and FPGA

UNIT I
Review of Logic Design: Implementation of logic functions with multiplexers.
Programmable Logic Devices: Architectures of PROM, PLA and PAL. Implementation of MSI circuits using Programmable Logic Devices.

UNIT II
Complex Programmable Logic Devices: Introduction to CPLD Architecture of CPLD. Logic Block, I/O Block, Interconnect matrix, and features of Altera max 7000 series, AMD Mach 4 and Xilinx XC-9500 CPLD.

UNIT III
Xilinx FPGAs: Introduction to FPGA, FPGA Programming Technologies. Architecture, Logic Blocks, I/O Block, Routing Architecture and features of Xilinx XC-4000, SPARTAN-II,Virtex-II and salient features of VirtexIII to VII devices.

UNIT IV
Actel and Altera FPGAs: Anti-Fuse Programmed FPGAs: Introduction, Architecture of Actel's Act1, Act2, and Act3 FPGAs. Designing of logic circuits with the ACT devices. Logic Block, I/O Block, Routing Architecture and features of Altera's Flex 10000 series FPGA.

UNIT V
Digital Design Flow: Digital design tools for FPGAs. Digital design flow for CPLDs and FPGAs. Importance of Placement and Routing, Introduction to ASICs: Semi-Custom and Full-Custom ASICs.

Text books:

1. S. Trimberger, Edr, "Field Programmable Gate Array Technology", Springer Publication., 2011.
2. Ronald J.Tocci, Neal S. Widmer, Gregory L. Moss "Digital Systems", 10/e, Pearson academic press 2011.
3. P.K.Chan& S. Mourad, "Digital Design Using Field Programmable Gate Array", PHI, 1994.

Suggested Reading:

1. S. Brown, R.J.Francis, J.Rose, Z.G.Vranesic, “Field programmable gate array”, BSP, 2007.
2. Altera, AMD, Actel, “Manuals Xilinx”, 2015.
3. Ian Grout, “Digital Systems Design with FPGAs and CPLDs”, Elsevier, 2008
4. Bob Zeidman, ―Designing with FPGAs & CPLDs, CMP Books, Berkeley, Calif 2002.
5. John V. Oldfield, Richard C. Dorf, “Field Programmable Gate Arrays”, Wiley India.1995

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18EC E12

DATA ANALYTICSFOR SIGNAL PROCESSING

(Program Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Programming using MATLAB/Python, Probability and Statistics and Linear Algebra.

Course Objectives:

This course aims to:

1. Find a meaningful pattern in data.
2. Insights from data through visual representation.
3. Implementation of various machine learning algorithms.
4. Handle large scale analytics projects from various domains such as image and speech signals.
5. Develop intelligent decision support systems.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Explain data science fundamentals.
2. Explore the principles of probability and statistical theory.
3. Understand various machine learning algorithms using applied statistics.
4. Analyze supervised and unsupervised learning models with regression and classification techniques.
5. Construct various applications of image and speech processing using MATLAB/Python.

Unit-I:

Introduction to Data Analytics: **Descriptive Statistics**: The Central limit theorem, distributions of the sample mean and the sample variance for a normal population, Sampling distributions (Chi-Square, t, F, z), **Probability Distributions:, and Inferential Statistics**: Inferential Statistics through Testing of Hypothesis: Testing for Attributes – Mean of Normal Population – One-tailed and two-tailed tests, F-test and Chi-Square test, Permutation & Randomization test.

Unit-II:

Regression & ANOVA: Regression ANOVA (Analysis of Variance): One way and two-way variance. Machine Learning: Introduction and Concepts, differentiating algorithmic and model-based frameworks, Regression: Ordinary Least Squares, Ridge Regression, Lasso Regression, Regression and Classification.

Unit-III:

Supervised and Unsupervised Learning with Regression and Classification techniques : Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Support Vector Machines (SVM), Ensemble Methods: Random Forest, Clustering: Partitioned based Clustering - K-means Clustering, Principal Component Analysis (PCA); Hierarchical Clustering - Agglomerative- Divisive- Distance measures; Neural networks- the perceptron algorithm- multilayer perceptron's(MLP)- back propagation nonlinear regression (BPMLP)- multiclass discrimination- training procedures- dimensionality reduction interpretation.

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Unit-IV:

Data Analytics in Speech processing:

Speech recognition using Python: Understanding and visualization of the Speech/Audio data, Spectral representation of speech/audio data: Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), Spectrogram.

Natural Language Processing: Text pre-processing, Parsing and exploratory data analysis. Supervised or unsupervised model of the data, Evaluation and Deployment using Python.

Unit-V:Data Analytics in Image processing:

Transformation of images/videos data using Python: Segmentation and feature extraction, detection of relationships between variables, features and time, Extraction of time stamped variables, Image Compression using K-means Clustering.

Textbooks:

1. Hastie, Trevor, et al." The elements of statistical learning" Vol. 2. No. 1. New York: springer, 2009.
2. Montgomery, Douglas C., and George C. Runger "Applied statistics and probability for engineers" John Wiley & Sons, 2010.
3. C. Bishop, "Pattern Recognition and Machine Learning, Springer", 2006.
4. John Mueller and Luca Massaron, "Machine Learning for Dummies", John Wiley & Sons, 2016.

Suggested Reading:

1. Little, Max A. *Machine Learning for Signal Processing: Data Science, Algorithms, and Computational Statistics*. Oxford University Press, USA, 2019.
2. Chellappa, Rama, and Sergios Theodoridis. *Signal Processing Theory and Machine Learning*. Academic Press, 2014.

18ECE13

SATELLITE COMMUNICATION

(Program Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of fundamental concepts of analog, digital communication and antennas is required.

Course objectives:

This course aims to:

1. Develop awareness about satellite orbits, orbital mechanics and orbital effects.
2. Make the students acquire the knowledge of various satellite subsystems.
3. Make the student to design a satellite link and understand the functioning of VSATs and DBS TV.

Course outcomes:

Upon completion of this course, students will be able to:

1. Extend the fundamental concepts of analog and digital communications in understanding a basic communication satellite system and satellite orbits.
2. Apply the principles of orbital mechanics to locate the satellite and examine the orbital effects on satellites.
3. Compare the Multiple access techniques for satellite communications and demonstrate the understanding of launch mechanisms and satellite subsystems.
4. Design an appropriate satellite communication link for the given specifications
5. Appraise the working principle and related aspects of DBSTV and VSAT.

UNIT-I

Introduction to Satellite Communication: Brief history of satellite communications, satellite services, frequency allocations, basic communication satellite system – earth segment and satellite segment, advantages and applications of satellite communications, salient features of Indian communication satellites. Introduction to satellite orbits – LEO, MEO, HEO, Polar orbits, sun-synchronous orbits, geo-synchronous and geo-stationary orbits.

UNIT-II

Orbital Mechanics: Kepler's laws, describing the orbit of a satellite, locating the satellite in the orbit and with respect to earth, orbital elements.

Look Angle Determination: sub-satellite point, elevation and azimuth angle calculations, visibility test.

Orbital Perturbations: Longitudinal changes and inclination changes

Orbital Effects on Communication System Performance

UNIT-III

Launches and Launch Vehicles: Launch vehicles, placing satellites into geo-stationary orbit, salient features of Indian launch vehicles – PSLV and GSLV.

Satellite Subsystems: Attitude and orbit control system, TTC&M, power systems, communication subsystems, satellite antennas, reliability and redundancy.

Satellite Multiple Access: Comparison of FDMA, TDMA and CDMA systems in the context of satellite communications.

UNIT-IV

Satellite Link Design: Basic transmission theory, system noise temperature and G/T ratio – noise temperature, calculation of system noise temperature, noise figure and noise temperature, design of down link, uplink design, design for specified C/N – combining C/N and C/I values, overall $(C/N)_0$ with uplink and downlink attenuation, attenuation in rain, uplink attenuation and $(C/N)_{up}$, downlink attenuation and $(C/N)_{dl}$, satellite communication link design procedure.

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UNIT-V

DBS TV: Introduction, power rating and number of transponders, frequencies and polarization, transponder capacity, home receiver outdoor unit and indoor unit.

VSAT: Overview, network architecture, modulation, coding and interference issues, brief introduction to VSAT antennas, indoor and outdoor units.

Text Books:

1. Timothy Pratt Charles, W Bostian, and Jeremy and E.Allnutt, "Satellite Communications", 2/e,, John Wiley,1986.
2. Dennis Roddy, "Satellite Communications", Fourth edition, McGraw Hill, 2006.

Suggested Reading:

1. M. Richharia, "Satellite Communication Systems: Design Principles", McGraw Hill, 2/e, 2003.
2. Gagliardi Robert M, "Satellite Communications", 2/e, Van Nostrand Reinhold, 1991.

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18MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
This course aims to:

1. To demonstrate the importance of Managerial Economics in Decision Making.
2. To explain the concept of Accountancy and provide basic knowledge on preparation of Final accounts.
3. To understand the importance of Project Evaluation in achieving a firm's Objective.

Course Outcomes:
After completion of the course, student will be able to:

1. Apply fundamental knowledge of Managerial Economics concepts and tools.
2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3. Understand Production and Cost relationships to make best use of resources available.
4. Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
5. Evaluate Capital and Capital Budgeting decision based on any technique.

Unit-I
Introduction to Managerial Economics
Introduction to Economics and its evolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

Unit-II
Demand and Supply Analysis
Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

Unit-III
Production and Cost Analysis
Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns; Internal and External Economies of Scale.
Cost Analysis: Cost concepts – Types of Costs, Cost-Output Relationship – Short Run and Long Run; Market structures – Types of Competition, Features, Price Output Determination under Perfect Competition, Monopoly and Monopolistic Competition; Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

Unit-IV
Accountancy
Book-keeping, Principles and Significance of Double Entry BookKeeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments. Ratio Analysis.

Unit-V
Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional andDiscounted Cash Flow Methods - Numerical problems.

Suggested Readings:

1. Mehta P.L., "Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2016.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 11th Edition, 2013.
3. Panday I.M. "Financial Management", 11th edition, Vikas Publishing House, 2015.
4. Varshney and K L Maheswari, Managerial Economics, Sultan Chand, 2014.
5. M. Kasi Reddy and S. Saraswathi, Managerial Economics and Financial Accounting, Prentice Hall of India Pvt Ltd, 2007.
6. A. R. Aryasri, Managerial Economics and Financial Analysis, McGraw-Hill, 2013.

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18EC C23

DIGITAL SIGNAL PROCESSING LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: The knowledge of basics of signals, systems, linear algebra and calculus are required.

Course Objectives:
This course aims to:
1. Simulation of DFT, FFT, Digital filters and multirate concepts using MATLAB.
2. Understand spectral analysis of noisy signals using MATLAB.
3. Implementation of digital filters on DSP Processor.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Illustrate linear convolution and correlation using MATLAB.
2. Design the digital filters using MATLAB.
3. Examine the performance of multirate techniques using MATLAB.
4. Experiment with decimator and interpolator on DSP processor.
5. Implement the digital filters on DSP processor.

List of Experiments

(A) Experiments on signal processing using MATLAB.
1. Basic matrix operations and Generation of test signals.
2. Linear Convolution, circular convolution and Correlation
3. Discrete Fourier Transform (DFT) and Fast Fourier Transform(FFT)
4. FIR filter design using different windows
5. IIR filter design: Butter worth, Chebyshev type 1 and 2: LPF, HPF, BPF & BSF filter.
6. Spectral Analysis of noisy signal using Welch's method
7. Interpolation and Decimation
8. Multistage filter
9. Structured enquiry: Hum noise reduction using FIR filter
10. Open ended enquiry: Spectral Analysis of non-stationary signals.

(B) Experiments on DSK and CCS
1. Study of procedure to work in real- time
2. Solutions of difference equations
3. Linear Convolution
4. Implementation of FIR filter
5. Implementation of second order IIR filters
6. Decimation and Interpolation

Note:
1. Minimum of 6 from Part A and 4 from Part B is mandatory.
2. For Part "A", MATLAB with different toolboxes like Signal Processing, Signal Processing block set and SIMULINK/ MATHEMATICA/ any popular software can be used.

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Sample Mini Projects

1. Design the best IIR band pass filter to meet the given specifications:
   Pass band cut off frequencies: [500 600] Hz
   Stop band cut off frequencies: [525 675] Hz
   Pass band ripple: < 2dB
   Stop band attenuation: >60dB
   Phase response: Approximately linear in pass band
   Consider Butterworth, Chebyshev, Elliptic and Bessel filters
2. Design the best low pass filter to meet the given specifications:
   Pass band cut off frequency: 1K Hz
   Stop band cut off frequency: 3K Hz
   Pass band ripple: < 2dB
   Stop band attenuation: >80dB
   Group Dealy: < 5ms
   Phase response: Approximately linear in pass band
   Consider FIR and Elliptic filters.
3. Design a three stage multirate filter to meet the given specifications:
   Pass band cut off frequency: 450 Hz
   Stop band cut off frequency: 500 Hz
   Pass band ripple: <3dB
   Stop band attenuation: >40dB
   Sampling frequency: 40 KHz
   Compare with single stage filter.
4. Consider a clean speech signal of length 5000 samples and compute the Power Spectrum. Now add 0dB random noise. Compute the power spectrum using Welch and Eigen value Estimation method and also compare with the original spectrum.

Suggested Reading:

1. Vinay K. Ingle and John G. Proakis, “Digital Signal Processing using MATLAB”, 4/e, Cengage learning, 2011.
2. B. Venkataramani and M. Bhaskar, “Digital Signal Processor architecture, programming and application”, 6/e, TMH, 2006.

18ECC24

MICROCONTROLLERS LAB

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Prerequisite: Basic knowledge of programming in C language.

Course Objectives:
This course aims to:
1. Develop and understand the 8051 and ARM7 C programming
2. Understand the usage of Integrated Development Environment (Keil)
3. Control the operation of various peripherals using 8051 and ARM7 microcontroller

Course Outcomes:
Upon completing this course, students will be able to:
1. Develop the programs of 8051 and ARM using their respective instruction set.
2. Understand the usage of various debugging tools available to program different microcontrollers
3. Build code for 8051 and ARM7 to interface various input/output modules
4. Analyze the hardware and software interaction and integration.
5. Design and develop the 8051 and ARM 7 based embedded systems for various applications

List of Experiments

I. 8051 Programming

1. Familiarity and use of 8051 microcontroller trainer kit, Keil IDE and simple programs under different addressing modes.
2. Assembly programming using instruction set
3. Timer and counter operations and programming using 8051.
4. Interfacing applications using LED, switch, relay and buzzer.
5. Generation of waveforms using DAC by interfacing it with 8051.
6. Stepper motor interfacing.
7. LCD interfacing.
8. Development of Embedded 'C' Code based on the module specifications. (under Structured enquiry)

II. ARM7 Programming

1. Study and use of LPC214x Microcontroller trainer kit and simple programs using its instruction set
2. Interfacing applications using LED, switch, relay and buzzer.
3. DC Motor interfacing.
4. Programming on-chip ADC.
5. Waveform generation using internal DAC.
6. Development of Embedded 'C' Code based on the module specifications. (under Structured enquiry)

III. Design an experiment related to the Embedded Application of your choice using 8051/ARM based architectures. (under Open ended enquiry)

Suggested Reading:

1. Mazidi M.A, Mazidi JG &Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C", 2/e, Pearson Education, 2007.
2. Philips semiconductors, "ARM 7 (LPC 214x) user manual", 2005.

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18ECC25

MICROWAVE ENGINEERING LAB

Instruction	2 P Hours per Week
Duration of *SEE*	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

This course aims to:

1. To understand the characteristics of Reflex Klystron Oscillator (RKO) and Gunn Oscillator.
2. To learn frequency measurement techniques using cavity wave meters.
3. To determine VSWR for various loads using slotted section.
4. To calculate power ratios at ports of various microwave components.
5. To learn measurement of impedance for various microwave loads.
6. To plot the radiation pattern for an antenna.

Course Outcomes:

Upon completing this course, students will be able to:

1. Examine the characteristics of RKO and Gunn Oscillator.
2. Compare the relation between guide wavelength, free space wavelength and cut off wavelength.
3. Measure VSWR for various loads at microwave frequencies.
4. Estimate the microwave power ratios at various ports of microwave components.
5. Evaluate unknown impedance of various microwave loads.

List of Experiments

1. Characteristics of Reflex Klystron Oscillator- To find the mode numbers and efficiencies of different modes.
2. Characteristics of Gunn diode and Gunn diode oscillator.
3. Measurement of frequency and Guide wavelength: Verification of the relation between guidewavelength, free space wavelength and cut-off wavelength.
4. Measurement of VSWR for the given loads.
5. Measurement of impedance for horn antenna, matched load, slide screw tuner etc.
6. Characteristics of Directional coupler.
7. Characteristics of E-plane, H-plane and Magic Tee.
8. Characteristics of Circulator.
9. Radiation pattern of horn antenna.
10. Study of various antennas like dipoles, loops, Yagi antenna, log periodic antenna and theirradiation pattern.
11. Structured enquiry: Calibration of given attenuator using microwave bench in X-band frequency.
12. Open ended enquiry: Measurement of impedance for inductive /capacitive window in X-band frequency.

Sample Mini Projects:

1. To design microwave components such as: Directional couplers, circulators and Hybrid junctions using Simulation software.
2. To design antenna arrays such as: Binomial, Chebyshev, using Simulation software.

References:

1. Department Laboratory Manual.
2. G.S. Raghu Vamsi, "Basic microwave techniques and Laboratory manual", 2nd Edition, New age international publishers, 2009.

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16EC C32

DATA COMMUNICATION AND COMPUTER NETWORKS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student must have taken a course on digital communication.

Course Objectives: This course aims to:

1. Provide a conceptual foundation for the study of data communications using the Open Systems Interconnect (OSI) model for layered architecture.
2. Understand theconcepts of switched communication networks, performance of data link layer protocols for error and flow control.
3. Study and understand the principles of network protocols, routing algorithms and internetworking, Network security, Internet applications

Course Outcomes: Upon completion of this course, students will be able to:

1. Identify different tasks of computer communications networks and protocol architectures.
2. Analyze and compare circuit switching and packet switching concepts and understand ATM network concepts and the performance of various Data link control protocols for flow control and error control.
3. Analyze the services and functions of the networks layer and recognize the different internetworking devices and their functions.
4. Understand how routing is carried out in large open networking environment and the operations of major internet routing protocols such as ICMP, ARP, OSPF and BGP.
5. Understand the importance of basic network security measures such as encryption, Authentication protocols and study standard Internet applications protocols.

UNIT – I

Introduction: Data Communication and Networking for Today's Enterprise, a Communications Model, Data Communications, Networks. The Need for Protocol Architecture and Standardization, the TCP/IP Protocol Architecture, the OSI reference Model, Line Configurations. Basic concepts of networking.Network topologies. Types of Network: LAN, MAN, WAN.

UNIT – II

Switched Communications Networks: Circuit-Switching Networks, Circuit-Switching Concepts Soft switch Architecture, Packet-Switching Principles, X.25, Frame relay. ATM Networks-Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, and ATM Service Categories.

UNIT – III

Data Link Layer: Design issues, Services provided to the Network layer, framing, Error Control, Flow Control. Elementary Data Link Control protocols: Stop and Wait, Sliding Window, Go Back-N, and Selective Repeat. High-Level Data Link Control (HDLC).

MAC Sub Layer: Multiple Access Protocols: ALOHA, CSMA, Comparison of IEEE Standards IEEE 802.3, 802.4, 802.11, 802.15, 802.16.

UNIT – IV

Network Layer: Network Layer Design Issues, Routing algorithms: Shortest Path Routing, Flooding, Distance Vector Routing, Hierarchical routing, Broadcast, Multicast, Congestion Control- Congestion Control Algorithms. Quality of service.Inter-Networking. The Network Layer in Internet-IP Version 4 protocol, IP Addressing, Comparison of IPV4 and IP V6, Internet Control Protocols-ICMP, ARP, OSPF and BGP.

UNIT – V

Transport Layer: The transport Service, Elements of Transport Layer, TCP and UDP protocol header formats. **Network Security and Internet Applications:** Cryptography techniques, Authentication Protocols. Applications layer protocols: Domain Name System, SNMP, Electronic Mail, and World Wide Web.

Text Books:

1. W. Stallings, "Data and Computer Communications", eight Edition, Prentice Hall - 2007.
2. A. Tanenbaum and D. Wetherall, "Computer Networks", fifth Edition, Prentice-Hall, 2011.

Suggested Reading:

1. Behrouz A. Forouzan, "Data Communication and Networking", Fourth Edition, McGraw-Hill Forouzan Networking Series, McGraw-Hill, 2007.
2. S. Keshav, "An Engineering Approach to Computer Networking", Second Edition, AddisonWesley Professional Pearson Education, 2001.

16EC C33

PRINCIPLES OF GNSS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamental concepts of communication are required.
Course Objectives: This course aims to:
1. Explain the basic principle of operation of GPS, GPS ephemerides and signal structure.
2. Make the students to understand various coordinate systems and highlight the effect of various errors affecting GPS signals.
3. Make the students to appreciate the significance of other GNSS systems, principle of DGPS and augmentation systems.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand the principle of operation of GPS and GPS ephemerides.
2. Analyze GPS signal structure and significance of various coordinate systems
3. Estimate the various errors and their effect on position estimation.
4. Compare other global and regional navigational systems
5. Apply DGPS principle and also analyze various augmentation systems. Use of GPS in Surveying, Mapping and Navigation.

UNIT-I
GPS Fundamentals: GPS System Segments: space, control and user segments, Principle of operation, Current status of GPS satellite constellation. Orbital Mechanics: GPS ephemeris data, algorithm for computation of satellite's position from ephemeris data. Time References: solar and sidereal days, UTC time, GPS time.

UNIT-II
GPS Signals: Legacy GPS signals: Signal structure, Operating frequencies, C/A and P-Code, Navigation message, Modernized GPS signals: list of signals and their significance. Range measurements: code and carrier measurements, User position estimation with PRN codes.
Coordinate systems: Earth Centered Earth Fixed (ECEF) coordinate system, Earth Centered Inertial (ECI) coordinate system, Geodetic coordinate system, Ellipsoid and Geoid, Regional and Global Datum, World Geodetic System (WGS-84).

UNIT-III

GPS Error Sources: Satellite clock error, ephemeris error, Receiver clock errors, satellite and receiver instrumental bias, Multipath error, receiver measurement noise, ionospheric error and tropospheric error, Klobuchar model, ionospheric delay estimation using dual frequency measurements and UERE. Dilution of precision: HDOP, VDOP, TDOP, PDOP & GDOP.

UNIT-IV

Data Formats: RINEX Observation and Navigation Data formats
GNSS: architecture, operation and signals of other global satellite systems such as Galileo, Beidou, GLONASS and regional systems such as IRNSS, QZSS.

UNIT-V

Differential GPS (DGPS): Principle of DGPS, Types of DGPS: Local Area DGPS (LADPS), Wide Area DGPS (WADGPS). **GPS Augmentation Systems:** Principle of operation of Satellite Based Augmentation system (SBAS) and Ground Based Augmentation System (GBAS): **GNSS Applications** Surveying, Mapping, Marine, air and land Navigation, Military and Space Application.

Text Books:

1. Elliot D Kaplan and Christopher J Hegarty, "Understanding GPS principles and applications", Artech House Publishers, 2/e Boston & London 2005.
2. PratapMisra and Per Enge, "Global Positioning System Signals, Measurement and Performance", Ganga- Jamuna Press, 2/e, Massachusetts, 2010.

Suggested Reading:

1. B.Hofmann, Wellenhof, H.Lichtenegger, and J.Collins, "GPS Theory and Practice," Springer Verlog, 5/e, 2008.
2. Ahmed El-Rabbany, "Introduction to GPS", Artech House Publishers, 2/e, Boston 2006.
3. Bradford W.Parkinson and James J. Spilker, "Global Positioning system: Theory and Application",Vol.II, American Institution of Aeronautics and Astronautics Inc., Washington, 1996.

16EC C34

RADAR AND SATELLITE COMMUNICATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: To study this course, knowledge of Communication, Electromagnetic theory and antennas is required.

Course Objectives: This course aims to:

1. To learn the principles of operation of Radar systems.
2. To know the various types of tracking Radars.
3. To develop awareness about launching a satellite, communication system and the orbital effects of a satellite.

Course Outcomes: Upon completion of this course, students will be able to:

1. Identify various building blocks of pulse Radar, analyze its operation and predict the range performance.
2. Measure the speed and direction of moving targets in spite of blind speeds.
3. Compare various tracking Radar mechanisms.
4. Understand basic satellite construction, sub systems, launching mechanisms and its operation.
5. Analyze LOS propagation and calculate the path loss in a satellite link. Calculation of G/T and C/N ratios of a path link and understand.

UNIT-I

Introduction to Radar, Radar block diagram and operation, Radar frequencies, Applications of Radar, Prediction of range performance, minimum detectable signal, receiver noise, probability density function, SNR, Integration of Radar pulses, Radar cross-section of targets, PRF and range ambiguities, transmitter power, system losses.

UNIT-II

Doppler effect, CW Radar, FM CW Radar, multiple frequency CW radar. MTI Radar, delay line canceller, range gated MTI Radar, blind speeds, staggered PRF, limitations to the performance of MTI Radar, non-coherent MTI Radar.

UNIT-III

Tracking Radar: Sequential lobbing, conical scan, Monopulse: amplitude comparison and phase comparison methods, Low angle tracking, tracking in range, comparison of various trackers, Radar antennas.

UNIT-IV

Orbital Mechanics and Launchers: Orbital elements, Locating the satellite with respect to the earth, sub- satellite point, look angles, Orbital effects in communication system performance, Satellite sub-systems: Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system, Communications subsystems (transponders), Space craft antennas.

UNIT-V

Introduction to satellite link design, considerations for design of satellite system, basic transmission theory, system noise temperature and G/T ratio, design of down link and uplink, design of satellite links for specified C/N, overall C/N for uplink and downlink.

Text Books:

1. Merril. I. Skolnik, "Introduction to Radar Systems", 3/e, MGH, 2001.
2. Timothy Pratt and Charles Bostian, "Satellite Communications", John Wiley,1986.
3. Dennis Roddy, "Satellite Communication Systems", McGraw Hill publications, 4th Edition, 2017.

Suggested Reading:

1 M. Richharia, "Satellite Communication Systems: Design Principles", MacMillan, 2/e,2003.

16EC C35

VLSI DESIGN

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of Verilog HDL and MOS Transistor Theory.

Course Objectives: This course aims to:

1. Study the concepts of Verilog HDL, simulation and synthesis process/ concepts.
2. Learn the various characteristics of MOS transistor, process steps in IC fabrication.
3. Learn the various concepts required to obtain the digital logic layout diagrams. To know various subsystem design concepts.

Course Outcomes: Upon completion of this course, students will be able to:

1. Simulate and synthesize digital logic designs.
2. Understand characteristic behavior of MOSFET and layout design rules.
3. Analyze the process steps in IC fabrication
4. Design CMOS based logic circuits.
5. Understand the design concepts of memories and VLSI testing.

UNIT – I

Advanced Verilog HDL: Functions and tasks, Switch level Modeling, UDP, Design of Mealy and Moore state models using Verilog, Logic Synthesis, Synthesis Design flow, Gate level Netlist.

UNIT – II

Introduction to MOS Technology, Basic MOS Transistor action: Enhancement and Depletion Modes. Basic electrical properties of MOS, Threshold voltage and Body Effect.

MOS and CMOS circuit Design Process: MOS Layers, Stick diagrams, Lambda based Design rules and Layout diagrams.

UNIT – III

Process steps in IC fabrication Crystal growth and wafer preparation Czochralski process- apparatus- silicon shaping, slicing and polishing- Diffusion, Ion implantation- Annealing process- Oxidation process- Lithography- Photolithography, electron beam and x-ray lithography- Chemical vapour deposition (CVD)- epitaxial growth- reactors- metallisationand packaging.

UNIT – IV

Design of MOS inverters with different loads. Basic Logic Gates with CMOS: INVERTER, NAND, NOR, AOI and OAI gates. Transmission gate logic circuits, BiCMOS inverter, D flip flop using Transmission gates.

UNIT – V

Subsystem Design: Multiplexor, Comparator, Shifters, Programmable Logic Arrays. Memories: 1T, 3T Dynamic RAM Cell, 6T Static RAM Cell. NOR and NAND based ROM Memory Design.

Testing: Introduction to Testing, Fault models, Controllability, Observability.

Text Books:

1. Samir Palnitkar, "Verilog HDL: A guide to Digital design and synthesis", 2/e, Pearson Education, 2008.
2. Kamran Eshraghian, Douglas A. Pucknell, SholehEshraghian, "Essentials of VLSI circuits and systems", PHI, 2011.
3. Neil H E Weste, David Harris, Ayan Banerjee "CMOC VLSI Design A circuit and System Perspective", 3/e, Pearson Education, 2006.

Suggested Reading:

1. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL", PHI, 2005.
2. John P. Uyemura, "Introduction to VLSI Circuits and systems", John Wiley & Sons, 2011.
3. Morris Mano M. and Michael D.Ciletti, "Digital Design with an Introduction to Verilog HDL", 5th edition, Pearson 2013.

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16EC E09

REAL TIME OPERATING SYSTEMS
(Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisites: Prior knowledge ofComputer Organization and Architecture is required.

Course Objectives: This course aims to:
1. Learn about the fundamental need of Real Time operating systems.
2. Understand the concepts of different RTOS.
3. Study the linux based target system design process.

Course Outcomes: Upon completion of this course, students will be able to:
1. Understand Real-time operating system requirements and applications.
2. Categorize different scheduling approaches for real time scheduler.
3. Compare different real time systems.
4. Analyze the inter task communication in RTOS.
5. Apply the linux based embedded system design process.

UNIT-I

Introduction to Operating Systems: Operating System objectives and functions, Evolution of operating systems, Developments leading to modern Operating Systems, Virtual machines, OS design consideration for multiprocessor and multicore, Overview on traditional and modern Unix OS, Differences between GPOS and RTOS

UNIT-II

Real Time System Basics: Basic model of a real time system, characteristics, applications, types of real time tasks, timing constraints, Uniprocessor Scheduling: Criteria for scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin. **Real Time Task Scheduling:** Earliest Deadline First (EDF): Implementation, shortcoming. Rate Monotonic Algorithm (RMA): Implementation, issues associated with RMA

UNIT-III

Commercial Real Time Operating System: Time services, Features of RTOS, Unix as a RTOS, Non pre-emptive kernel, dynamic priority levels, POSIX: genesis of POSIX, Overview, Real Time POSIX standard, Priority inversion, priority ceiling and priority Inheritance protocols , a survey of contemporary RTOS: PSOS, VRTX, QNX, µC-OS-II and RT-Linux,

UNIT-IV

Introduction toVxworks: Salient Features, Multitasking, Task state transition, Task Control: Task Creation and Activation, Task Stack, Task Names and IDs, Task Options, Task Information, Task Deletion and Safety, Semaphore and message queues related functions

UNIT-V

Linux Development Process: Types of Host /Target Development and debug setup, Generic Architecture of an Embedded Linux System, System start up, Types of Boot configurations, System Memory Layout, Development Tools: Project Workspace, IDE, GNCC cross platform, selecting and configuring kernel, setting up boot loader.

Text Books:

1. William Stallings, "Operating Systems Internals and Design Principles," 7/e, Pearson Education, 2014.
2. Rajib Mall, "Real Time Systems", Pearson Education, 2/e, 2007.
3. KarimYaghmour, "Building Embedded Linux Systems" O'Reilly, 2003.

Suggested Reading:

1. Silberschatz, Galvin, Gange" Operating Systems Concepts" 8/e , Wiley Education, 2007.
2. Wind River SystemsInc.,"VxWorks Programrs Guide", 1997.

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16EC E10

SPEECH PROCESSING
(Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student should have knowledge of digital signal processing.

Course Objectives: This course aims to:

1. Provide students with the knowledge of basic characteristics of speech signal in relation to production and hearing of speech by humans.
2. Describe basic algorithms of speech analysis and pitch extraction.
3. Learn the various algorithms for speech recognition like HMM and Dynamic warping.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the basic characteristics of speech signal in relation to production and hearing of speech by humans.
2. Analyze speech and extract features for speech applications.
3. Design the various applications like recognition, synthesis, and coding of speech.
4. Use HMM for speech recognition.
5. Implement dynamic warping technique in real time problems.

UNIT – I

Fundamentals of Digital speech processing: Discrete time signals and systems, Transform representation of signals and systems (Z-transform, FT and DFT), fundamentals of digital filters (IIR and FIR), Sampling theorem. Decimation and interpolation of sampled waveforms, Mechanism of speech production: Vocal track and physiology.

UNIT - II

Time Domain Models of Speech Processing: Time dependent processing of speech, Short –time Energy and average magnitude, short time average Zero crossing rate, Speech versus Silence Discrimination using Energy and Zero crossing, Pitch period estimation, short time auto correlation estimation, Short time average magnitude difference function, median smoothing and speech processing.

UNIT – III

Digital Representation of the Speech Waveform: Sampling speech signals, review of statistical model of speech signal, Instantaneous Quantization, Adaptive Quantization, Differential quantization. Qualitative treatment for Delta modulation and Differential PCM.Comparison of systems, LDM to PCM conversion and PCM to ADPCM conversion.

UNIT-IV

Homomorphic Speech Processing: Introduction, Homomorphic systems for convolution - properties of the complex Cepstrum, computational considerations, complex cepstrum of speech, Pitch detection, Formant estimation, The homomorphicVocoder. Introduction to Text-to-speech and Articulator speech synthesis.

UNIT-V

Linear Predictive Analysis: Solution ofthe LPC equations, Comparisons between the methods of the solutions of LPC Analysis equations, Frequency Domain interpretation of LPA, Applications of the LPC parameters Speaker recognition systems, Problems in Automatic speech recognition, Dynamic warping, Hidden Markow models, speaker Identification / verification.

Text Books

1. Rabiner L.R and Schafer R .W, "Digital Processing of Speech Signals", PHI,1978.
2. Owens F.J., "Signal Processing of Speech", Macmillan, New Electronics, 1/e,2000.

Suggested Reading:

1. Daniel Jurefsky and James H. Martin, "Speech and Language Processing", PHI, 2/e, 2003.
2. Papamchalis, "Practical Approaches to speech coding", PHI, 1987.
3. Rabinerand Bernard Gold, "Theory and Application of Digital Signal Processing", 2nd edition, PHI, 1988.

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16EC E12

APPLICATIONS OF IoT IN ECE
(Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge onProgramming and Problem Solving, Computer Organization, Embedded systems.

Course Objectives: This course aims to:

1. Provide an overview of Internet of Things, building blocks of IoT and the real-world applications.
2. Introduce Python Programming language and packages.
3. Introduce Rasberry Pi device, its interfaces and Django Framework.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the terminology, enabling technologies and applications of IoT
2. Apply the concept of M2M (machine to machine) and describe the differences between M2M and IoT.
3. Understand the basics of Python Scripting Language which is used in many IoT devices
4. Describe the steps involved in IoT system design methodology
5. Design simple IoT systems using Rasberry Pi board with sensors, actuators and develop web applicationsusing python based framework called Django.

UNIT-I

Introduction and Concepts: Introduction to Internet of Things: Definitions and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols, Logical Design of IoT, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies-Wireless Sensor Networks, Cloud Computing, Communication Protocols, IoT Levels & Deployment Templates.

UNIT-II

Domain Specific IoTs: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

IoT and M2M: Introduction, M2M, Differences between IoT and M2M, Software Defined Networking, Network Function Virtualization.

UNIT-III

Introduction to Python: Motivation for using Python for designing IoT systems, Language features of Python, Data types: Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules, packaging, Python packages of Interest for IoT: JSON, XML, HTTPLib, URLLib, SMTPLib.

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-V

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Rasberry Pi-About the Rasberry Pi board, Rasberry Pi interfaces-Serial, SPI, I2C. **IoT Physical Servers and Cloud Offerings:** Introduction to cloud storage models and Communication APIs, WAMP: AutoBahn for IoT, Xivelycloud for IoT. **Python Web Application Framework:** Django Framework-Roles of Model, Template and View

Text Books:

1. ArshdeepBahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", Universities Press, 2015.
2. Tony Gaddis, "Starting out with Python", 3rd edition, Pearson, 2015.

Suggested Reading:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st edition, press Publications, 2013.
2. Matt Richardson, Shawn Wallace, O'Reilly, "Getting Started with Raspberry Pi", SPD, 2014.

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16EC E13

DIGITAL IMAGE PROCESSING

(Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: This course requires the knowledge of Digital Signal Processing.

Course Objectives: This course aims to:

1. Understand the image formation and its digital representation.
2. Learn representation of images in frequency domain and enhancement techniques.
3. Students would be able to solve the problems related to image compression and restoration.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand how images are formed, sampled and quantized.
2. Applyvarious transforms like Fourier, DCT, Haar, DWT and Hadamard Transform to different applications.
3. Apply image enhancement techniques for practical applications
4. Implement the image restoration techniques.
5. Implement image compression techniques by removing the redundancy.

UNIT – I

Elements of Digital Image Processing Systems, Digital image representation, elements of visual perception, Image sampling and Quantization, Basic Relationships between pixels.

UNIT – II

Properties and Applications of Fourier Transform: FFT, Discrete cosine transform, Hadamard transform, Haar transform, Slant transform, DWT and Hotelling transform.

UNIT – III

Spatial Enhancement Techniques: Histogram equalization, direct histogram specification, Local enhancement.Frequency domain techniques: Low pass, High pass and Homomorphic Filtering, Image Zooming Techniques.

UNIT – IV

Image Degradation model, Algebraic approach to restoration, inverse filtering, Least mean square filter, Constrained least square restoration and interactive restoration. Speckle noise and its removal techniques.

UNIT – V

Redundancies for image compression, Huffman Coding, Arithmetic coding, Bit-plane coding, loss less and lossy predictive coding. Transform coding techniques: Zonal coding and Threshold coding.

Text Books:

1. Gonzalez R.C. and Woods R.E., "Digital Image Processing" 2/e, PHI, 2005.
2. A.K.Jain, "Fundamentals of Digital Image processing", PHI, 1989.

Suggested Reading:

1. Madhuri A, Joshi, "Digital Image Processing: An algorithmic Approach", PHI, 2006.
2. U Qidwai, C.H.Chen, "Digital Image Processing",CRC Press, (Taylor & Francis), YesdeePublications,First Indian Reprint 2013.

16EC C36

ADVANCED SIMULATION LAB

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Prerequisite: A prior knowledge of Digital logic, Signal processing, Communication and DCCN is required.

Course Objectives: This course aims to:

1. Understand the importance and applications of virtual instrumentation and computer networks.
2. Learn the basic programming concepts in LabVIEW and Network Simulator.
3. Develop real time applications using LabVIEW.

Course Outcomes: Upon completion of this course, students will be able to:

1. Learn how to develop basic applications in the LabVIEW graphical programming environment.
2. Develop ability for programming in LabVIEW using various data structures, program structures, plotting the graphs and charts for system monitoring, processing and controlling.
3. Apply knowledge of mathematics and engineering to formulate and study or solve engineering problems, including problems at the interface of engineering.
4. Develop LabVIEW skills to engineer basic computer-based instrumentation.
5. Develop applications that are scalable, readable, maintainable and reliable.

LAB EXPERIMENTS

1. Familiarization with simulation tools: LabVIEW and Network Simulator2 (NS2).
2. Loops, Structures and Math-script in LabVIEW.
3. Implementation of Combinational circuits (Multiplexer, Demultiplexer, Decoder and Encoder, Priority Encoder) using myRIO.
4. Design of Sequential circuits (Flip flops, counters and registers).
5. Convolution and correlation of signals.

6. FIR and IIR Filter design.
7. Implementation of Analog modulation and Demodulation schemes (AM and FM) using my RIO.
8. Digital carrier modulation and demodulation schemes (ASK, FSK and PSK)
9. Time domain analysis (State variable analysis).
10. Frequency domain analysis (Nyquist and Bode plots).
11. Creation of a wired network and data transmission between the nodes with at least four nodes using NS2.
12. Creation of a wireless network and data transmission between the nodes with at least four nodes using NS2.
13. Simulation of the data transfer between the nodes using TCP/UDP using NS2.
14. Sensor data acquisition using my DAQ.
15. Voltage / Current Sweep generation using my DAQ.

Mini Project cum Design Exercises

Design and development of any one of the following applications.

a) Digital IIR Notch filter
b) Multistage design of decimator and interpolator
c) Discrete multitone transmitter and receiver
d) ALU Design using Lab VIEW
e) Universal shift registers using Lab VIEW
f) Code converters using Lab VIEW
g) Design of PLL using Lab VIEW

Suggested Reading:

1. Jeffrey Travis and Jim Kring, "Lab VIEW for Everyone: Graphical Programming Made Easy and Fun", 3rd Edition, Prentice Hall, 2007.
2. TeerawatIssariyakul and EkramHossain, "Introduction to Network Simulator NS 2", 2nd Edition, Springer, 2012.

16ECC37

ELECTRONIC DESIGN AND AUTOMATION LAB

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Prerequisite: Digital design fundamentals and synthesis & simulation concepts.
Course Objectives: This course aims to:

1. Simulate and synthesize combinational and sequential logic circuits
2. Simulate switch level modules
3. Learn implementation procedure for any design on FPGA and To study the speed, power and area constraints of FPGA/CPLD

Course Outcomes: Upon completion of this course, students will be able to:

1. Analyze simulation and synthesis reports of combinational and sequential logic circuits
2. Obtain gate level net-list and RTL diagrams
3. Implement sequence detector using FSM on FPGA
4. Design adders using UDP and Tasks & Functions.
5. Implement mini projects on FPGA/CPLD

Part A

Write VERILOG Code, Simulate and Implement the following on FPGA.

1. Code Converters.
2. Encoders, Decoders, Priority Encoder and Comparator.
3. Registers/Counters.
4. Sequence Detector using Mealy and Moore type state machines.
5. Any application of UDP.
6. Tasks and Functions.

Note:

1. All the codes should be implemented appropriately using Gate level, Dataflow and BehavioralModeling.
2. All the programs should be simulated using test benches.

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Part B

Switch Level Modeling of CMOS Circuits

1. Basic Logic Gates: Inverter, NAND and NOR.

2. Half Adder and Half Subtractor.
3. 4:1 Multiplexer.
4. 2:4 Decoder.
5. Design of inverter circuit using Simulation tool.
6. Design of NAND Gate using Simulation tool.
7. Design of NOR Gate using Simulation tool.

Mini Project: Simulation and implementation of various digital designs on FPGA.

Suggested Reading:

1. Michal D.Ciletti, “Advanced digital design with Verilog HDL”, Pearson Edition, 2011.
2. Samir Palnitkar, “Verilog HDLA Guide to Digital Design and Synthesis”,Pearson 2nd edition, 2003.
3. Cadence Design Systems (Ireland) Ltd., “Cadence manual”, 2013.

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16EC C38

PROJECT SEMINAR

Instruction	3 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/ Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks:Max.

Marks: 50

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

16EC E18

VLSI TECHNOLOGY
(Elective-VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: A prior knowledge of Semiconductor Properties.

Course Objectives: This course aims to:
1. Understand the procedure for preparing silicon wafer and its cleaning.
2. Know the various fabrications steps involved.
3. Learn the concepts of packaging and Testing of ICs.

Course Outcomes: Upon completion of this course, students will be able to:
1. Analyze the functions of various layers in IC fabrication.
2. Demonstrate the concepts of preparing silicon wafer from the raw material.
3. Understand and analyzation of chemical reactions in the formation of various layers.
4. Compare various lithography process steps.
5. Understand concepts of involved in packaging of VLSI circuits and testing.

UNIT-I:

Introduction: Integrated Circuits Review of history of VLSI technology progress, Silicon as the Base Material and its advantages, various Layers of ICs: Substrate, Active Layer, Oxide/Nitride Layers, Metal/Poly Silicon Layers. Functions of each of the Layers.Introduction to clean room technology.

UNIT-II

Silicon Wafer Preparation: Electronic Grade Silicon, CZ and FZ Methods of Single Crystal Growth, Silicon Shaping, Mechanical Operations, Chemical Operations.

Wafer-Cleaning Technology: Introduction, basic concepts of wafer cleaning, Wet-cleaning technology, Dry-cleaning technology.

UNIT-III

Oxide Growth: Structure of SiO2, Growth Mechanism and Dynamics, Oxide Growth by Thermal method.

Lithography: Steps involved in Photolithography, photo resists and their characteristics, optical exposure systems contact and projection systems, steppers, X-ray Electron Beam Lithography

UNIT-IV

Etching: Chemical, Electro Chemical Plasma (Dry Etching) Reactive Plasma Etching
Ion Implantation: Range and Penetration Depth, Damage and AnnealingIon Implantation machine.
Diffusion: Constant and Infinite Source Diffusions, Diffusion Profiles and Diffusion Systems.

UNIT-V

Dielectric and Polysilicon Film Deposition Techniques: Chemical Vapour Deposition (CVD) and associated methods like LPCVD and PECVD. PVD thermal evaporation a sputtering.
Packaging and Metallization: Die, Bonding and Packaging, Testing.

Text Books:

1. J. D. Plummer, M .D. Deal and P. B. Griffin, "The Silicon VLSI Technology Fundamentals, Practice and modeling", Pearson Education 2009.
2. S.M. Sze, "VLSI Technology", McGrawhill International Editions, 2017.

Suggested Reading:

1. CY Chang and S.M. SZe ,"VLSI Technology", Tata McGraw-Hill Companies Inc. with effect from the academic year 2016-2017.
2. Stephen A, "The Science and Engineering of Microelectronic Fabrication", Campbell Oxford 2001.

16CS O10

BASICS OF MACHINE LEARNING USING PYTHON

Elective-VII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Get an idea of Machine Learning algorithms to solve real world problems.
2. Study various machine learning algorithms.
3. Analyze data using machine learning techniques.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Understand the basics concepts of Machine Learning and Python.
2. Apply feature engineering techniques and visualization tools to the data.
3. Analyze the various types of data by using python based machine learning techniques.
4. Identify and evaluate various recommender systems.
5. Design solutions to real world problems using deep learning algorithms.

UNIT - I

Introduction to Machine Learning: Introduction, Machine Learning process. **Introduction to Python**: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT - II

Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python. **Data Visualization:** Various charts, histograms, plots.

UNIT - III

Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression. **Classification:** Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes.

UNIT - IV

Unsupervised Learning: Clustering, K-Means clustering, Hierarchical clustering. **Text Analysis:** Basic text analysis with Python, regular expressions, NLP, text classification. **Time Series Analysis**: Date and time handling, window functions, correlation, time series forecasting.

UNIT - V

Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework. **Recommender System:** Recommendation engines, collaborative filtering.

Text Books:

1. AbhishekVijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018
2. Tom Mitchel "Machine Learning", Tata McGraWHill, 2017
3. ReemaThareja "Python Programming", Oxford Press, 2017.

Suggested Reading:

1. Yuxi Liu, Python Machine Learning by Example, 2nd Edition, PACT, 2017

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.html
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

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16ME O01

ENTREPRENEURSHIP

Elective-VII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Course Outcomes: Upon completion of this course, the student will be able to:

1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

UNIT-I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT-II

Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT-III

Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

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UNIT-IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V

Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.
3. Sudha G.S., "Organizational Behavior", National Publishing House, 1996.

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16EG O02

GENDER SENSITIZATION

Elective-VII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Develop students' sensibility with regard to issues of gender in contemporary India.
2. Provide a critical perspective on the socialization of men and women.
3. Expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

UNIT-I

Understanding Gender:

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)

Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2), Introduction. Preparing for Womanhood.Growing up Male.First lessons in Caste.Different Masculinities.

UNIT-II

Gender and Biology:

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4), Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10), Two or Many? Struggles with Discrimination.

UNIT-III

Gender and Labour:

Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3), "My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7), Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages andConditions of Work.

UNIT-IV

Issues Of Violence

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6), Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading:"*Chupulu*".

Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8), Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading:New Forums for Justice.Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11), Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face ofViolence.

UNIT-V

Gender: Co - Existence

Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12), Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.Additional Reading: Rosa Parks-The Brave Heart.

Textbooks:

1. A Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, AsmaRasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published byTelugu Akademi, Hyderabad, Telangana State, 2015.

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Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. AbdulaliSohaila. "I Fought For My Life…and Won."Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

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16CE O02

DISASTER MITIGATION AND MANAGEMENT

Elective-VIII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. Impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. Enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. Enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. Equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course Outcomes: Upon completion of this course, the student will be able to:

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various

participatory approaches/strategies and their application in disaster management

UNIT-I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II:

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III:

Human Induced Hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storied buildings.

UNIT-IV:

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR Programs in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni," Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh," Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs". Government of India, "National disaster management plan, Part I and II",
2. K. K. Ghosh," Disaster Management", APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

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16CS O06

FUNDAMENTALS OF DBMS

Elective-VIII (Open)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: File Structures.

Course Objectives: This course aims to:

1. Learn data models, conceptualize and depict a database system using E-R diagram.
2. Understand the internal storage structures in a physical DB design.
3. Know the fundamental concepts of transaction processing techniques.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Understand the find fundamental components of the DBMS.
2. Design the database schema and develop E-R model.
3. Devise queries using relational algebra and SQL.
4. Apply normalization techniques and solve problems using various Indexing techniques.
5. Understand transaction processing, Concurrency control and recovery techniques.

UNIT - I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures. **Database Design and E-R Model:** Basic concepts,Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations. **Structured Query Language:** Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

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UNIT - III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT - IV

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files. **Transaction Management:** Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT - V

Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery, **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, "An Introduction to Database Systems", Eight Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, Johnnes Gehrke, "Database Management Systems", Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, "Fundamentals of Database Systems", Fourth Edition, Pearson Education, 2006.

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16EC C39

SEMINAR

Instruction	3 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summaryand Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

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Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

16EC C40

PROJECT

Instruction	6P Hours per Week
Duration of SEE	Viva -Voce
SEE	100 Marks
CIE	50 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/ Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 50)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

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Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project ● Innovations ● Applications ● Live Research Projects ● Scope for future study ● Application to society
	20	Viva-Voce

20EC C102

ADVANCED DIGITAL SIGNAL PROCESSING

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: The knowledge of DSP is required.

Course Objectives:
This course aims to:
1. Analyze digital IIR and FIR filters for the given specifications.
2. Understand the basic concepts of Multirate digital signal processing.
3. Learn the various parametric and non-parametric spectral estimation methods.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Design digital filters for the given specifications.
2. Interpret the concepts of Multirate digital signal processing.
3. Understand the concepts of linear prediction filters.
4. Analyze various Power Spectral Estimation methods for random signals
5. Develop the various applications of Digital signal processing.

UNIT-I
Review of Digital Filters: FFT Algorithms, review of digital filter design and structures-Basic FIR/IIR filter design &structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, Cascaded, lattice structures and parallel realization of FIR and IIR filters.

UNIT-II
Multirate DSP: Introduction, Decimator and Interpolator, Sampling rate conversion, multistage decimator and interpolator,polyphase filters, Uniform digital filter banks, two channel Quadrature Mirror Filter bank- perfect reconstruction conditions.

UNIT-III
Linear Prediction &Optimum Linear Filters: Introduction to discrete random signals, Power Density spectrum, Ergodic process. Forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, FIR and IIR Wiener filters.

UNIT-IV
Power Spectrum Estimation: Estimation of Spectra from Finite-Duration Observations of Signals, NonparametricMethods for Power Spectrum Estimation-Bartlett and Welch methods. Parametric methods for Power Spectrum Estimation-Yule Walker method and Burg method. Minimum-Variance Spectral Estimation, Eigen analysis Algorithms for Spectrum Estimation, Piserenko method and MUSIC algorithm.

UNIT-V
Applications of Digital Signal Processing: Dual-Tone Multi frequency Signal Detection, Spectral analysis of sinusoidal signals, Non-stationary signals and Random signals, sub band coding of speech signals, JPEG-2000, Trans multiplexers, Introduction to wavelets.

Text Books:

1. J.G.Proakis and D.G.Manolakis, "Digital signal processing: Principles, Algorithm andApplications", 4th Edition, Prentice Hall, 2007.
2. Sanjit. K. Mitra, "Digital signal processing", 3rd edition, McGraw Hill,2006.

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Suggested Reading:

1. Emmanuel Ifeachor, Barrie W.Jervis, "Digital signal Processing, A Practical Approach", 2nd edition, Pearson, 2011.
2. Roberto Cristi, "Modern Digital signal Processing", Cengage learning, 2012.

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20EC C104

WIRELESS AND MOBILE COMMUNICATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Requires concepts of Electromagnetic theory, Antennas and Wave propagation and Digital Communication.

Course Objectives:
This course aims to:
1. Facilitate the understanding of the basics of Cellular System design Fundamentals and Large-scale propagation models
2. Provide the concepts of small-scale fading and Equalization.
3. Build knowledge on multiple access techniques, GSM and Cellular Standards.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand and apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques.
2. Analyze path loss and interference for wireless telephony and their influences on a mobile-communication system's performance.
3. Distinguish various multiple-access techniques for mobile communications and their advantages and disadvantages.
4. Evaluate GSM and CDMA systems by functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using these technologies.
5. Devising the higher generation Cellular standards 3G, 4G & 5G.

UNIT-I
The Cellular Concept System Design Fundamentals: Frequency reuse, Frequency management, Channel Assignment Strategies, Handoff Strategies, Co-channel Interference, Adjacent channel interference, Power control for Reducing Interference, Cell Splitting and Sectoring.

UNIT-II
Mobile Radio Propagation Large Scale Path Loss: Free space propagation model, Reflection, Ground Reflection (Two-Ray) model, Diffraction: Knife – edge Diffraction Model, Scattering, Practical link budget design using path loss models: Log Normal Shadowing, Determination of percentage of coverage area, Outdoor propagation models: Okumura and Hata models, Indoor propagation models: Partition losses (same floor), Partition losses between floors, Signal penetration into buildings.

UNIT-III
Mobile Radio Propagation Small Scale Fading and Multipath: Impulse response model, Spread Spectrum Sliding Correlator Channel Sounding, Parameters of Mobile Multipath Channels, Types of Small-Scale Fading: Flat Fading, Frequency selective Fading, Fast Fading and Slow Fading.

UNIT-IV
Equalization: Fundamentals of Equalization, Training a Generic Adaptive Equalizer, Equalizers in Communication Receiver, Linear Equalizers, Non-Linear Equalizers: Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for Adaptive Equalization: Zero Forcing Algorithm and Least Mean Square Algorithm.

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UNIT-V

Multiple Access Techniques: FDMA, TDMA and CDMA. Comparison of these technologies based on their signal separation, Advantages and Disadvantages.
GSM System: Architecture and Interfaces, Subsystems, Logical channels, HSCSD, GPRS and EDGE.
IS-95 System: Architecture, Air interface, Physical and Logical channels, Evolution of CDMA One to CDMA 2000.
Higher Generation Cellular Standards: 3G, 4G, VoLTE, UMTS, Introduction to 5G.

Text Books:

1. T.S.Rappaport, "Wireless Communications Principles and Practice", 2nd edition, PHI,2002.
2. William C.Y.Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2ndedition, TMH, 1995.
3. V.K.Garg and J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.

Suggested Reading:

1. V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009.
2. AshaMehrotra, "A GSM system Engineering" Artech House Publishers Boston, London,1997.

20ME M103

RESEARCH METHODOLOGY AND IPR

(Mandatory Course)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Course Objectives:
This course aims to:
1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Course Outcomes:
Upon completion of this course, students will be able to:
1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT-I
Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT-II
Literature Survey Report Writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT-III
Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT-IV
Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non-parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, F-test, z-test

UNIT-V
Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, how to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright? How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004.

Suggested Reading:

1. AjitParulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd, 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010

20EC E103

GLOBAL NAVIGATION SATELLITE SYSTEMS

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A prior knowledge of fundamental concepts of satellite communication is required.

Course Objectives:

This course aims to:

1. Explain the basic principles of various positioning techniques and introduce GPS operating principle, signal structure.
2. Make the students to understand errors affecting GNSS performance and analyze various parameters of RINEX data.
3. Make the students appreciate the significance of other GNSS systems, principle of DGPS and augmentation systems.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Apply the concepts of satellite communications in understanding the principle of operation of various navigation systems and GPS fundamentals.
2. Analyze GPS signal structure and receiver functioning and compare coordinate systems and datum.
3. Interpret the effect of various error sources and satellite geometry on the performance of GNSS and explain the necessity of GPS modernization and importance of integration aspects.
4. Develop data processing methods using observation and navigation data for GPS and DGPS.
5. Compare other global and regional navigational systems and assess the performance of various augmentation systems.

UNIT-I:

GPS Fundamentals: INS, Trilateration, Hyperbolic navigation, Transit, GPS principle of operation, architecture, operating frequencies, orbits, Keplerian elements.Solar and Sidereal days, GPS and UTC Time.

UNIT-II:

GPS Signals: Signal structure, C/A and P-Code, ECEF and ECI coordinate systems and WGS 84 and Indian Datums, Important components of receiver and specifications, link budget.

UNIT-III:

GPS Error Models: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Antenna Phase center variation, multipath; estimation of Total Electron Content (TEC) using dual frequency measurements, Various DOPs, UERE. Spoofing and Anti-spoofing: Future GPS satellites, new signals and their benefits GPS integration – GPS/GIS, GPS/INS, GPS/pseudolite, GPS/cellular.

UNIT-IV:

GPS Data Processing, DGPS and Applications: RINEX Navigation and Observation formats, Code and carrier phase observables, linear combination and derived observables, Ambiguity resolution, cycle slips, Position estimation. Principle of operation of DGPS, architecture and errors.

UNIT-V:

Other Constellations and Augmentation Systems: Other satellite navigation constellations: GLONASS, Galileo, Beidou and QZSS.

IRNSS: Architecture, signals, advantages and limitations,

SBAS and GBAS: Relative advantages of SBAS and GBAS, Wide area augmentation system (WAAS) architecture, GAGAN, EGNOS and MSAS. Local area augmentation system (LAAS) concept.

Text Books:

1. B.HofmannWollenhof, H.Lichtenegger, and J.Collins, “GPS Theory and Practice”, Springer Wien, New York, 2000.
2. PratapMisra and Per Enge, “Global Positioning System Signals, Measurements, and Performance”, Ganga-Jamuna Press, Massachusetts, 2001.

Suggested Reading:

1. Ahmed El-Rabbany, “Introduction to GPS”, Artech House, Boston, 2002.
2. Bradford W. Parkinson and James J. Spilker, “Global Positioning System: Theory and Applications”, Volume II, American Institute of Aeronautics and Astronautics, Inc., Washington, 1996.

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20EC E112

SOFTWARE DEFINED AND COGNITIVE RADIO

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A prior knowledge of signal processing, Communication and spectral knowledge is required.

Course Objectives:
This course aims to:
1. Make the students understand the difference between Superhetrodyne Radio and Software defined Radio
2. Differentiate between Cognitive Radio (CR) and SDR and study their architectures.
3. Make the students know about the CR signal processing Techniques and applications.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Explain the difference between the super-heterodyne receiver, Software Defined Radio and Cognitive Radio.
2. Analyze the different architectures of SDR and CR used for real time systems.
3. Evaluate and choose the various spectrum sensing methods based on application.
4. Implement various signal processing techniques for CR networks.
5. Choose the USRP and WARP boards based on the facilities required for a CR application.

UNIT-I

Introduction to SDR: What is Software-Defined Radio, The Requirement for Software-Defined Radio, Legacy Systems, The Benefits of Multi-standard Terminals, Economies of Scale, Global Roaming, Service Upgrading, Adaptive Modulation and Coding, Operational Requirements, Key Requirements, Reconfiguration Mechanisms, Handset Model, New Base-Station and Network, Architectures, Separation of Digital and RF, Tower-Top Mounting, BTS Hoteling, Smart Antenna Systems, Smart Antenna System Architectures.

UNIT-II

Basic Architecture of a Software Defined Radio: Software Defined Radio Architectures, Ideal Software Defined Radio Architecture, Required Hardware Specifications, Digital Aspects of a Software Defined Radio, Digital Hardware, Alternative Digital Processing Options for BTS Applications, Alternative Digital Processing Options for Handset Applications, Current Technology Limitations, A/D Signal-to-Noise Ratio and Power Consumption, Impact of Superconducting Technologies on Future SDR Systems.

UNIT-III

Signal Processing Devices and Architectures: General Purpose Processors, Digital Signal Processors, Field Programmable Gate Arrays, Specialized Processing Units, Tilera Tile Processor, Application-Specific Integrated Circuits, Hybrid Solutions, Choosing a DSP Solution. GPP-Based SDR, Non real time Radios, High-Throughput GPP-Based SDR, FPGA-Based SDR, Separate Configurations, Multi-Waveform Configuration.

UNIT-IV

Cognitive Radio: Techniques and signal processingHistory and background, Communication policy and Spectrum Management, Cognitive radio cycle, Cognitive radio architecture, SDR architecture for cognitive radio, Spectrum sensing Single node sensing: energy detection, cyclo-stationary and wavelet-based sensing- problem formulation and performance analysis based on probability of detection versus SNR. Cooperative sensing: different fusion rules, wideband spectrum sensing- problem formulation and performance analysis based on probability of detection versus SNR.

UNIT-V

Cognitive Radio: Hardware and Applications: Spectrum allocation models. Spectrum handoff, Cognitive radio performance analysis.Hardware platforms for Cognitive radio (USRP and WARP), details of USRP board, Applications of Cognitive radio

Text Books:

1. Peter B. Kenington,"RF and Baseband Techniques for Software Defined Radio", Artech House, Inc © 2005.
2. Eugene Grayver,"Implementing Software Defined Radio", Springer, New York Heidelberg Dordrecht London, ISBN 978-1-4419-9332-8 2013.
3. Bruce A. Fette, "Cognitive Radio Technology", Elsevier, ISBN 10: 0-7506-7952-2, 2006.

Suggesting Reading:

1. Hüseyin Arslan, "Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems", Springer, ISBN 978-1-4020-5541-6 (HB), 2007.

20EGA101

ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	--
Credits	Non-Credit

Course Objectives:
This course aims to:
1. To the various purposes of Research Papers and help them infer the benefits and limitations of research.
2. To developing the content, formulating a structure and illustrating the format of writing a research paper.
3. In differentiating between qualitative and quantitative research types.
4. To constructing paragraphs and developing thesis statement.
5. To producing original research papers while avoiding plagiarism.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Illustrate the nuances of research paper writing and draw conclusions about the benefits and limitations of research.
2. Classify different types of research papers and organize the format and citation of sources.
3. Review the literature and categorize between different types of research.
4. Draft paragraphs and write thesis statement in a scientific manner.
5. Develop an original research paper while acquiring the knowledge of how and where to publish their papers.

UNIT-I
Academic Writing
Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT-II
Research Paper Format
Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT-III
Research Methodology
Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT-IV
Process of Writing a Research Paper
Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft–Revising/Editing - The final draft and proof reading.IEEE Style.

UNIT-V
Research Paper Publication
Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Freepublications - Paid Journal publications – /Advantages/Benefits

Text Book:
1. C. R Kothari, Gaurav, Garg, Research Methodology Methods and Techniques, New Age International Publishers. 4^{th}Edition.

Suggested Reading:

1. Day R, “How to Write and Publish a Scientific Paper”, Cambridge University Press, 2006.
2. MLA “Hand book for writers of Research Papers”, East West Press Pvt. Ltd, New Delhi, 7th Edition.
3. Lipson, Charles(2011), Cite Right: A Quick Guide to Citation Styles; MLA, APA, Chicago,The Sciences, Professions, and more (2nd Edition). Chicago [u.a]: University of Chicago Press.

Online Resources:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. NPTEL: https://nptel.ac.in/courses/121/106/121106007/
3. https://www.classcentral.com/course/swayam-introduction-to-research-5221

20EC C106

ADVANCED DIGITAL SIGNAL PROCESSINGLAB

Instruction	4 P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Prerequisite: The knowledge of signal processing algorithms and MATLAB are required.

Course Objectives:
This course aims to:
1. Simulation of FFT, Multirate concepts using MATLAB.
2. Spectral analysis of noisy signals using MATLAB.
3. Implementation of digitalfilters using MATLAB.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Implement FFT algorithms for linear filtering and correlation using MATLAB.
2. Design and realize of the digital filters using MATLAB.
3. Experiment with multirate techniques using MATLAB.
4. Perform parametric and non-parametric estimation of PSD using MATLAB.
5. Design and Implement the adaptive filters using MATLAB.

List of Experiments:
1. FFT of input sequence and comparison with DFT.
2. Design of IIR Butterworth, Chebyshev type-I &II, Elliptic LPF, HPF, BPF &BSF and calculate Group delay.
3. Design of FIR LPF, HPF, BPF &BSF using windows. Multiband FIR filter and calculate Group delay.
4. State space matrix representation from difference equation
5. Solution of normal equation using Levinson Durbin
6. Decimation and Interpolation using rational factors
7. Design a Multistage decimator multirate filter
8. Maximally decimated analysis DFT filter bank
9. Cascade and parallel realization of digital IIR filter
10. Convolution and M fold Decimation.
11. Parametric Estimation of PSD
12. Nonparametric Estimation of PSD
13. Design of Adaptive filter using LMS algorithm.

Sample Mini Projects:

1. Design the best IIR band pass filter to meet the given specifications:
   Pass band cut off frequencies: [500 600] Hz
   Stop band cut off frequencies: [525 675] Hz
   Pass band ripple: ≤ 2dB
   Stop band attenuation: ≥ 60dB
   Phase response: Approximately linear in pass band Consider Butterworth, Chebyshev, Elliptic and Bessel filters
2. Design a three stage multirate filter to meet the given specifications:
   Pass band cut off frequency: 450 Hz
   Stop band cut off frequency: 500 Hz
   Pass band ripple: ≤ 3dB
   Stop band attenuation: ≥ 40dB
   Sampling frequency: 40 KHz

   Compare with single stage filter.

3. Consider a clean speech signal of length 5000 samples and compute the Power Spectrum. Now add 0dB random noise. Compute the power spectrum using Welch and Eigen value Estimation method and also compare with the original spectrum.

4. Design a speech signal compression using octave filter banks and also calculate the compression ratio.

Suggested Reading:

1. Vinay K. Ingle and John G. Proakis, "Digital Signal Processing using MATLAB", 4thedition, Cengage learning, 2011.

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20EC C108

WIRELESS AND MOBILE COMMUNICATION LAB

Instruction	4 P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Prerequisite: Requires concepts of Electromagnetic theory, Antennas & Wave propagation and Digital Communication.

Course Objectives:
This course aims to:
1. Facilitate the experimental setup for understanding the Cellular concepts and experiments using GSM and CDMA.
2. Provide the facility to learn AT commands in 3G networks andDSSS technique for CDMA to observe various spread spectrum parameters.
3. Build knowledge on concepts of software radio by studying building blocks such as Baseband and RF section.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Appraising Cellular concepts, GSM and CDMA networks.
2. Experimenting with GSM handset and fault insertion techniques.
3. Illustrate 3G communication system by means of various AT commands usage in GSM.
4. Testing on DSSS kit for implementing CDMA concept.
5. Develop concepts of Software Radio in real time environment

List of Experiments:

1. Study of DSSS technique for CDMA to observe effect of PN codes, Chip rate, Spreading factor and Processing gain.
2. Study of GSM handset for various signaling and Fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).
3. Study Transmitter and Receiver sections in Mobile Handset and also measure GMSK modulated signal.
4. Study various GSM AT Commands such as SMS and HTTP.
5. Study File system by AT commands in 3G network.
6. Establishing Call Setup, Estimation of Coverage area and Capacity in GSM and CDMA.
7. Develop concepts of Software radio by studying building blocks such as Baseband and RF section.
8. Develop Convolutional Encoder, Interleaver and De-Interleaver in Software Radio.
9. Study and analyze different modulation techniques in time and frequency domains using SDR Kit.
10. Estimation of GPS satellite position using RINEX data.
11. Estimation of key performance parameters of IRNSS L5 and S1 band signals.
12. Estimation of user position using GNSS Single Frequency receiver.

Suggested Reading:

1. T.S.Rappaport, “Wireless Communications Principles and Practice”, 2nd edition, PHI, 2002.

20EC C101

ADVANCED COMMUNICATION NETWORKS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Students should have in depth knowledge of Computer Networks.

Course Objectives:
This course aims to:
1. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
2. Provide the student with knowledge of advanced networking concepts and techniques.
3. Provide the student with knowledge of Real Time Communications over Internet and Packet Scheduling.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Recall the concepts and Issues of Real Time Communications over Internet.
2. Classify protocols and algorithms for Communication Networks.
3. Identify the mechanisms for Quality of Service in networking.
4. Analyze IP addressing challenges and services in Internet
5. Explain the different versions of IP Protocols, IP switching and MPLS Protocols.

UNIT-I
Overview of Internet Concepts, Challenges and History: Overview of -ATM. TCP/IPCongestion and Flow Control in Internet; Throughput analysis of TCP congestion control, TCP for high bandwidth delay networks and Fairness issues in TCP.

UNIT-II
Issues of Real Time Communications over Internet: Adaptive applications, Latency and throughput, Integrated Services Model (IntServ), Resource reservation Protocol. Characterization of Traffic by LinearlyBounded Arrival Processes (LBAP), Leaky bucket algorithm and its properties.

UNIT-III
Packet Scheduling Algorithms-Requirements and Choices: Scheduling guaranteed service Connections, GPS, WFQ and Rate proportional algorithms, High speed scheduler design; Theory of Latency Rate servers and delay bounds in packet switched networks for LBAP traffic; Active Queue Management - RED, WRED and Virtual clock, Control theoretic analysis of active queue management.

UNIT-IV
IP Address Lookup-Challenges: Packet classification algorithms and Flow Identification, Grid of Tries, Cross producting and controlled prefix expansion algorithm.Admission control in Internet: Concept of Effective bandwidth, Measurement based admission control; Differentiated Services in Internet (DiffServ), DiffServ architecture and framework.

UNIT-V
IPV4, IPV6, IP tunneling, IP switching and MPLS, Overview of IP over ATM and its Evolution to IP switching; MPLS architecture and framework, MPLS Protocols, Traffic Engineering issues in MPLS.

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Text Books:

1. J.F. Kurose & K.W. Ross, "Computer Networking- A top down approach featuring the internet", Pearson, sixth edition, 2013.
2. Nader F. Mir, "Computer and Communication Networks", second edition, 2015.

Suggested Reading:

1. Anurag Kumar, D. Manjunath and Joy Kuri, "Communication Networking: An Analytical Approach", Morgan Kaufman Publishers, 2004.
2. Jean Wairand and PravinVaraiya, "High Performance Communications Networks", 2nd edition, 2000.

20EC C103

ANTENNAS AND RADIATING SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Students should have prior knowledge of Electromagnetic waves.

Course Objectives:
This course aims to:
1. The basic principles of an antenna and its parameters for characterizing its performance.
2. The fundamental concepts of various types of antennas, arrays for customizing the pattern parameters.
3. The concept of aperture and microstrip antennas.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the radiation parameters of an antenna.
2. Apply the concept of current distribution to analyze the antennas.
3. Analyze the linear arrays for uniform distribution.
4. Appraise the characteristics of broad side, end fire arrays and non-uniform arrays.
5. Learn the aperture antennas using Huygen's principle, image theory and Microstrip antennas.

UNIT-I
Radiation Mechanism, Fundamental Parameters of Antennas: Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input Impedance, Region separation, Antenna Temperature, Antenna vector effective length, Friis Transmission equation, Significance of current distribution.

UNIT-II
Infinitesimal dipole, Analysis of Finite length dipole, half wave dipole, Ground effects, Small Circular loop, Circular loop with non-uniform current distribution.

UNIT-III
Linear Arrays: Two element array, N-Element array: Uniform Amplitude and spacing, Broadside and End fire arrays, Super directivity, planar array, Design consideration, Introduction to linear arrays with non-uniform distributions: Binomial and Tschebyscheff distribution.

UNIT-IV
Aperture Antennas: Huygen's Field Equivalence principle, Image theory, radiation equations, Rectangular Aperture. Horn Antennas: E-Plane, H-plane horns and Pyramidal horn antennas.

UNIT-V
Reflector Antennas: Plane reflector, parabolic reflector, Efficiency calculation of parabolic reflector antenna, Cassegrain reflectors.
Microstrip Antennas: Basic Characteristics, feeding mechanisms, Rectangular Patch design using TL method and Circular Patch design using cavity model method.

Text Books:

1. Constantine A. Balanis, "Antenna Theory: Analysis and Design," 4th Edition, John Wiley, 2016
2. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems," 2nd Edition, PHI, 2009
3. John D. Krauss, Ronald J. Marhefka& Ahmad S. Khan, "Antennas and Wave Propagation," 4th Edition, TMH, 2010

Suggested Reading:

1. Dennis Roody and John Coolen, "Electronic Communications", 4th Edition, Prentice Hall, 2008.
2. R.C.Johnson and H.Jasik, "Antenna Engineering hand book", Mc-Graw Hill, 1984.
3. I.J.Bhal and P.Bhartia, "Micro-strip antennas", Artech house, 1980.

20EC E111

SIGNAL INTELLIGENCE SYSTEMS

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Basic knowledge of Radar, Communication and Antenna concepts are required.

Course Objectives:
This course aims to:
1. Elucidate the concepts of electronic intelligence using the fundamentals of radar and localization techniques with necessary mathematical analysis.
2. Explain the operating principles of COMINT Systems based on various localization and position fixing techniques.
3. Provide salient features of EW Systems and Electronic Jamming.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Apply the knowledge of Communication and Antenna concepts in understanding the operating principles of Radar and Drones.
2. Discuss the salient features of EW Systems and identify the type of Electronic Jamming.
3. Analyze the intricacies of ELINT Systems.
4. Estimate the DF and position of ELINT/COMINT Systems for simple cases.
5. Interpret the type of modulation of COMINT systems.

UNIT-I

Principles of RADAR and DRONES: Radar Range equation, probability of false alarm, probability of detection, Radar cross section fluctuations, Blind speed, Pulse Repetition Frequency (PRF), Unambiguous range, Principles and Classification of Drones and their applications.

UNIT-II

Communication EW Systems and Techniques for Electronic Jamming: Introduction, Information warfare, Electronic warfare: Electronic support, Electronic attack, Electronic Protect. Typical EW System Configuration. Electronic attack: A General Description of the Basic Elements of Electronic Jamming, Communication jamming, jammer deployment, narrow band/partial-band jamming, barrage jamming, follower jammer, jamming LPI targets. Spoofing: Spoofing generation, detection and anti-spoofing.

UNIT-III

Electronic Intelligent (ELINT) Systems: Electronic Intelligence Defined, The Importance of Intercepting and Analyzing Radar Signals, Limitations Due to Noise, Probability of Intercept Problems. Inferring Radar Capabilities from observed Signal Parameters, Receivers for Radar Interception, Major ELINT Signal Parameters, the Impact of LPI Radar on ELINT.

UNIT-IV

Direction Finding: Direction Finding, Instantaneous Direction Finding. Amplitude Comparison AOA Measurement, Phase Interferometers.

Position Fixing Position fixing algorithms: Eliminating Wild Bearings, Stansfield Fix Algorithm, Mean-Squared Distance Algorithm. Single-site location techniques: Fix accuracy, fix coverage. Time of Arrival, Time difference of Arrival: Position-Fixing using TDOA Measurements, Differential Doppler.

UNIT-V

Communication Intelligent (COMINT) Systems: Encryption: Cryptologic Architectures, Pretty Good Privacy, Digital Signatures, Decryption, Recognition of Modulation: Analogue Modulated Signal Recognition Algorithms (AMRAs): Classification of each segment, Classification of a signal frame, Digitally Modulated Signal Recognition Algorithms (DMRAs): Classification of each segment, Classification of a signal frame.

Text Books:

1. Richard G. Wiley, “ELINT: The Interception and analysis of Radar Signals”, Artech House Inc., 2006.
2. Richard A. Poisel, “Introduction to Communication Electronic Warfare Systems”, 2nd edition, Artech house, Inc., 2008.

Suggested Reading:

1. Sergei A. Vakin, Lev N. Shustov, Robert H. Dunwell “Fundamentals of Electronic Warfare”, Artech House, Inc., 2001.
2. ElsayedElsayedAzzouz, Asoke Kumar Nandi, “Automatic Modulation Recognition of Communication Signals”, Springer Science+Business Media, B.V, 1996.

20EC E106

INTERNET OF THINGS

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge onProgramming and Problem Solving, Computer Organization and embedded systems.

Course Objectives:
This course aims to:
1. Provide an overview of Internet of Things, building blocks of IoT and the real-world applications.
2. Introduce Python Programming language and packages.
3. Introduce Raspberry Pi device, its interfaces and Django Framework.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the terminology, enabling technologies and applications of IoT
2. Apply the concept of M2M and understand the basics of modern networking with the concepts of SDN and NFV.
3. Understand the basics of Python Scripting Language which is used in many IoT devices.
4. Describe the steps involved in IoT system design methodology.
5. Design simple IoT systems using Raspberry Pi board with sensors, actuators and develop web applications using python-based framework called Django.

UNIT-I

Introduction and Concepts: Introduction to Internet of Things, definitions and characteristics of IoT, physical design of IoT-Things in IoT, IoT Protocols, Logical Design of IoT-IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IOT Enabling TechnologiesWireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels & Deployment Templates.

UNIT-II

Domain Specific IoTs: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle
IoT and M2M: Introduction, M2M, Differences between IoT and M2M, Software Defined Networking, Network Function Virtualization.

UNIT-III

Introduction to Python: Motivation for using Python for designing IoT systems, Language features of Python, Data types- Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules, packaging, file handling, data/time operations, classes, Exception handling, Python packages of Interest for IoT - JSON, XML, HTTPLib, URLLib and SMTPLib.

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-V

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Raspberry Pi-About theRaspberry Pi board, Raspberry Pi Interfaces-Serial, SPI, I2C, Other IoT Devices-pcDuino, BeagleBone Black, Cubieboard

IoT Physical Servers and Cloud Offerings: Introduction to cloud storage models and Communication APIs, WAMP-AutoBahn for IoT, Xivelycloud for IoT

Python Web Application Framework: Django Framework-Roles of Model, Template and View

Text Books:

1. ArshdeepBahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach, Universities Press", 2015.
2. Bill Lubanovic "Introducing Python: Modern Computing in Simple Packages", O’Reilly Media, Inc, USA, 2015.

Suggested Reading:

1. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st edition, Apress Publications, 2013.
2. Matt Richardson andShawn Wallace O'Reilly, “Getting Started with Raspberry Pi”, SPD, 2014.

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20EC A101

VALUE EDUCATION

(Audit Course)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	--
Credits	Non-Credit

Course Objectives:
This course aims to
1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Course outcomes:
After completion of the Course, Students will be able to
1. Summarize classification of values and values for self-development.
2. Identify the importance of values in personal and professional life.
3. Apply the importance of social values for better career and relationships.
4. Compile the values from holy books for personal and social responsibility.
5. Discuss concept of soul and reincarnation, values Dharma, Karma and Guna.

UNIT-I
Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behavior, standards and principles based on religion, culture and tradition.

UNIT-II
Value Cultivation, and Self-Management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III
Spiritual Outlook and Social Values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV
Values in Holy Books : ** Self-management and Good health; **and internal & external Cleanliness, Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V
Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasicgunas.

Text Books:
1. Chakroborty, S.K. “Values & Ethics for organizations Theory and practice”, Oxford University Press, New Delhi, 1998.
2. Jaya DayalGoyandaka, “Srimad Bhagavad Gita”, withSanskrit Text, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.

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20EC C105

ADVANCED COMMUNICATION NETWORKS LAB

Instruction	4 P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Prerequisite: Students should have in depth knowledge of Computer Networks.

Course Objectives:
This course aims to:
1. Provide the student with knowledge sub-netting and routing mechanisms.
2. Provide the student with knowledge of basic routing protocols for Network design and implementation.
3. Provide the student with knowledge configuring User Datagram Protocol.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Identify the different types of network devices and their functions within a network.
2. Understand and build the skills of sub-netting and routing mechanisms.
3. Understand basic protocols of computer networks, and how they can be used to assist in Network design and implementation.
4. Configure a network using Linux and a mail server for IMAP/POP protocols
5. Design and configure UDP Client Server

List of Assignments:
1. Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP, RARP) and Network Configuration Files.
2. Linux Network Configuration.
   a. Configuring NIC's IP Address.
   b. Determining IP Address and MAC Address using if-config command.
   c. Changing IP Address using if-config.
   d. Static IP Address and Configuration by Editing.
   e. Determining IP Address using DHCP.
   f. Configuring Hostname in /etc/hosts file.
3. Design TCP iterative Client and Server application to reverse the given input sentence.
4. Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call "select".
5. Design UDP Client Server to transfer a file.
6. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP deviceswitha default gateway and a default DNS address. Integrate the DHCP server with aBOOTP demon to automatically serve Windows and Linux OS Binaries based on clientMAC address.
7. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverseDNS and forward DNS, using TCP dump/Wire shark characterize traffic when theDNS server is up and when it is down.
8. Configure a mail server for IMAP/POP protocols and write a simple SMTP client inC/C++/Java client to send and receive mails.
9. Configure FTP Server on a Linux/Windows machine using an FTP client/SFTP clientCharacterize file transfer rate for a cluster of small files 100k each and a video file of700mb.Use a TFTP client and repeat the experiment.
10. Signaling and QoS of labeled paths using RSVP in MPLS.
11. Find shortest paths through provider network for RSVP and BGP.
12. Understand configuration, forwarding tables, and debugging of MPLS.

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Suggested Reading:

1. J.F. Kurose & K.W. Ross, “Computer Networking- A top down approach featuring the internet”, Pearson, Sixth Edition, 2013.
2. Nader F. Mir, Computer and Communication Networks, second edition, 2015.

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20EC C107

ANTENNAS AND RADIATING SYSTEMS LAB

Instruction	4 P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Prerequisite: The knowledge of antennas is essential.

Course Objectives:
This course aims to:
1. Understand the characteristics and radiation pattern of Infinitesimal antenna.
2. Simulate various antennas.
3. Study the effect of change in different parameters on antenna arrays.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Determine specifications, design, construct and test antenna.
2. Explore and use tools for designing, analyzing and testing antennas.
3. Apply the concept of current distribution to find the field patterns.
4. Estimate the effect of the height of the monopole antenna on the radiation characteristics.
5. Study the effect of the variation of phase difference 'beta' between the elements of the array and case studies.

List of Experiments:
1. Simulation of half wave dipole antenna.
2. Simulation of change of the radius and length of dipole wire on frequency of resonance ofantenna.
3. Simulationofquarterwave, fullwaveantennaandcomparisonoftheir parameters.
4. Simulation ofmonopole antenna with and without groundplane.
5. Study the effect of the height of the monopole antenna on the radiation characteristics of the antenna.
6. Simulation of a half wave dipole antennaarray.
7. Study the effect of change in distance between elements of array on radiation pattern of dipole array.
8. Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipole array.

Note: The above experiments are to be carried out by using any appropriate simulation software.

Suggested Reading:
1. Li Ming Yang,"HFSS antenna design", 2nd edition,Electronic Industry Press, 2014.

20EC C109

MINI PROJECT WITH SEMINAR

Instruction	4 P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Prerequisite: Knowledge of preparing slides by using power point presentations, Capable of searching for suitable literature and Presentation skills.

Course Objectives:
This course aims to:

1. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and references.
2. To expose and practice of searching and referring the required literature.
3. This is expected to provide a good initiation for the student(s) towards R&D.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Familiarize in searching the suitable literature in the chosen field.
2. Develop skills to understand and summarize the contents from the literature.
3. Ability to synthesize knowledge/ skills previously gained and applied in execution of a chosen technical problem.
4. Enhance oral presentation skills through power point presentations.
5. Learn and present the findings of their technical solution in a written report.

Guidelines:

1. As part of the curriculum in the II - Semester of the Program each student shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
2. Each student will be allotted to a faculty supervisor for mentoring.
3. Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
4. Mini projects shall have inter-disciplinary/ industry relevance.
5. The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
6. All the investigations are clearly stated and documented with the reasons/explanations.
7. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, detailed discussion on results, conclusions and references.

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Departmental Committee: Supervisor and two faculty coordinators

Guidelines forawarding Marks inCIE:	Max. Marks: 50	
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Departmental Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

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19EC E108

MIMO WIRELESS COMMUNICATIONS

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge on communication systems,antenna and wave propagation.

Course Objectives: This course aims to:

1. Understand the basic principles and need of MIMO systems
2. Analyze the MIMO system in terms of space-time coding and various beam forming methodologies.
3. Channel estimation for single carrier and multiple carrier systems.

Course Outcomes: Upon completion of this course, students will be able to:

1. Appreciate the need of MIMO antenna based wireless communication system.
2. Understand various diversity reception techniques for MIMO.
3. Analyze channel modeling and propagation, MIMO Capacity, space-time coding.
4. MIMO receivers, MIMO for multi-carrier systems and multi-user Communications.
5. Analyze cooperative/ coordinated multi-cell MIMO and appreciate the need of MIMO in 4G.

UNIT-I

Introduction to MultiAntenna Systems, Motivation, Types of Multi-Antenna Systems: Switched beam, Adaptive Array, MIMO vs. Multi-Antenna Systems.

UNIT-II

Diversity, Exploiting multipath diversity, Transmit diversity, Delay diversity, Cyclic delay diversity, Space time codes, The Alamouti scheme, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation.

UNIT-III

The generic MIMO problem, Eigenvalues and eigenvectors, Pre-coding and combining in MIMO systems, Advantages of pre-coding and combining, Disadvantages of pre-coding and combining, Codebooks for MIMO, Beam forming, Beam forming principles, Interference cancellation, Switched beam former, Adaptive beam former, Narrowband beam former, Wideband beam former.

UNIT-IV

MIMO in LTE, Pre-coding for spatial multiplexing, Pre-coding for transmit diversity, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environment, Narrowband and wideband channels, MIMO channel models.

UNIT-V

Channel Estimation, Channel estimation techniques, Estimation and tracking, Training Based channel estimation, Blind channel estimation, MMSE channel estimation, Channel estimation in single carrier systems, Channel estimation for OFDM.

Text Books:

1. Claude Oestges and Bruno Clerckx, "MIMO Wireless Communications: From Real-worldPropagation to Space-time Code Design", Academic Press, 1st edition, 2010.
2. Mohinder Janakiraman, "Space - Time Codes and MIMO Systems", Artech House Publishers, 2004.

Suggested Reading:

1. Jerry R.Hampton, "Introduction to MIMO Communications", Cambridge university press, 1st Edition, 2014.
2. Joseph C.Liberti and Jr. Bellcore, Theodore S. Rappaport "Smart Antennas for Wireless Communications", IS-95 and third generation CDMA applications,Prentice Hall, 1st Edition, 1999.

19CE O101

COST MANAGEMENT OF ENGINEERING PROJECTS
(Open Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:
1. Enable the students to understand the concepts of Project management.
2. Provide knowledge on concepts of Project Planning and scheduling.
3. Create an awareness on Project Monitoring and Cost Analysis
4. Provide adequate knowledge to the students on Recourse Management Costing-Variance Analysis
5. Train the students with the concepts of Budgetary Control for cost management and to provide basic platform on Quantitative techniques for cost management.

Course Outcomes: Upon completing this course, students will be able to:
1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
2. Determine the critical path of a typical project using CPM and PERT techniques.
3. Prepare a work break down plan and perform linear scheduling using various methods.
4. Solve problems of resource scheduling and levelling using network diagrams.
5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.

UNIT-I

Project Management: Introduction to project managements, stakeholders, roles, responsibilities and functional relationships. Principles of project management, objectives and project management system. Project team, organization, roles, responsibilities. Concepts of project planning, monitoring, staffing, scheduling and controlling.

UNIT-II

Project Planning and Scheduling: Introduction for project planning, defining activities and their interdependency, time and resource estimation. Work break down structure. Linear scheduling methods-bar charts, Line of Balance (LOB), their limitations. Principles, definitions of network-based scheduling methods: CPM, PERT. Network representation, network analysis-forward and backward passes.

UNIT-III

Project Monitoring and Cost Analysis: introduction-Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making, Time cost tradeoff-Crashing project schedules, its impact on time on time, cost. Project direct and indirect costs.

UNIT-IV

Resources Management and Costing-Variance Analysis: Planning, Enterprise Resource Planning, Resource scheduling and levelling. Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis

Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement

UNIT-V

Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative Techniques for Cost Management: Linear Programming, PERT/ CPM, Transportation Assignment problems, Simulation, Learning Curve Theory.

Text Books:

1. Charles T Horngren "Cost Accounting A Managerial Emphasis", Pearson Education; 14th edition 2012,
2. Charles T. Horngren and George Foster, "Advanced Management Accounting" Prentice-Hall; 6th Revised edition, 1987
3. Robert S Kaplan Anthony A. Atkinson, "Management & Cost Accounting" , Pearson; 2nd edition, 1996
4. K. K Chitkara, "Construction Project Management: Planning, scheduling and controlling", Tata McGraw-Hill Education. 2004.
5. Kumar Neeraj Jha "Construction Project Management Theory and Practice", Pearson Education India; 2nd edition, 2015.

19EC C110

DISSERTATION / PHASE - I

Instruction	20 P Hours per Week
Duration of SEE	—
SEE	—
CIE	100 Marks
Credits	10

Course Outcomes: At the end of the course:

1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, national/ international refereed journals and contact resource persons for the selected topic of research.
3. Students will learn to write technical reports.
4. Students will develop oral and written communication skills to present.
5. Student will defend their work in front of technically qualified audience.

Guidelines:

1. The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.

2. Seminar should be based on the area in which the candidate has undertaken the dissertation work.

3. The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.

4. The preliminary results (if available) of the problem may also be discussed in the report.

5. The work has to be presented in front of the committee consists of Head, Chairperson-BoS, Supervisor and Project coordinator.

6. The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

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Guidelines for the award of Marks:		Max. Marks: 100
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

Note : Department committee has to assess the progress of the student for every two weeks.

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19EC C111

DISSERTATION / PHASE - II

Instruction	32 PHours per Week
Duration of SEE	Viva - Voce
SEE	100 Marks
CIE	100 Marks
Credits	16

Course Outcomes: At the end of the course:

1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
2. Students will be able to design and develop an experimental set up/ equipment/test rig.
3. Students will be able to conduct tests on existing set ups/equipment and draw logical conclusions from the results after analyzing them.
4. Students will be able to either work in a research environment or in an industrial environment.
5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

Guidelines:

1. It is a continuation of Project work started in semester III.
2. The student has to submit the report in prescribed format and also present a seminar.
3. The dissertation should be presented in standard format as provided by the department.
4. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.
5. The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner (HoD and BoS Chair Person) guide/co-guide.
6. The candidate has to be in regular contact with his/her guide/co-guide.

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Guidelines for awarding marks in CIE:		Max. Marks: 100
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	10	Review 2
	10	Review 3
	15	Final presentation with the draft copy of the report reportstandard format
	10	Submission of the report in a standard format
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Analytical / Programming / Experimental Skills Preparation
	10	Report preparation in a standard format

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
External and Internal Examiner(s) together	20	Power Point Presentation
	40	Quality of thesis and evaluation
	20	Quality of the project ● Innovations ● Applications ● Live Research Projects ● Scope for future study ● Application to society
	20	Viva-Voce

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20ECC201

ANALOG AND DIGITAL CMOS VLSI DESIGN

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Pre-requisites: Analog and Digital design concepts.

Course Objectives:
This course aims to:

1. Characteristic behavior of MOSFET, CMOSFET, FINFET, TFET, Meta Gate Technology.
2. Physical design concepts.
3. Design of Analog and digital circuits.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Understand MOS structure, it's Behavior & fabrication process, various step in physical design flow of CMOScircuits, second order effects in MOS &ESD Models.
2. Design various types of combinational logic circuits and sequential logic circuits
3. Recall various advanced technologies in VLSI industry, the scaling issues, etc.
4. Analyze various analog amplifiers, Current mirror circuits and OP AMP
5. Design Basic Amplifiers, Current Mirrors, basic OPAMP, OP-AMP with different compensations

UNIT-I
Technology Scaling and Road map, Scaling issues, Standard 4 mask NMOS Fabrication process, Review: Basic MOS structure and its static behavior, Stick diagram and Layout, Inverter: Static CMOS inverter, Switching threshold and noise margin concepts and their evaluation of dynamic behavior, Power consumption.

UNIT-II
Physical Design Flow: Floor planning, Placement, Routing, CTS, Power analysis and IR drop estimation-static and dynamic ESD protection-human body model, Machine model, Combinational logic: Static CMOS design, Logic effort, Ratioed logic, Pass transistor logic, Dynamic logic Speed and power dissipation in dynamic logic Cascading dynamic gates, CMOS transmission gate logic.

UNIT-III
Sequential Logic: Static latches and registers, MUX based latches, Static SR flip-flops, Master-slave edge-triggered register, Dynamic latches and registers, advanced technologies: Giga-scale dilemma, Short channel effects, High–k, Metal Gate Technology.

UNIT-IV
Introduction to Analog Design, Second order effects MOS small signal model, Single Stage Amplifier: Common Source Amplifier, CS Stage with Source Degeneration, Common Drain Amplifier & Common Gate Stage (resistive load) Current Mirrors: Basic Current Mirrors, Cascode Mirrors, Special Current Mirror, Single Stage Amplifier: Common Source Amplifier with Current source load, Triode load,CM Load, Frequency response of CS stage, Source follower, Common gate stage, Gilbert cell.

UNIT-V

MOS Difference Pair (One Stage OPAMP), Operational Amplifiers: Two stage OPAMP, Fully differential amplifiers, Slew rate, PSRR, Compensation of two- stage OPAMP, op-amp based comparator, switched capacitor. Introduction to data converters-specifications.

Text Books:

1. J P Rabaey, A P Chandrakasan, B Nikolic, "Digital Integrated circuits: A design perspective", Prentice Hall electronics and VLSI series, 2nd edition 2003
2. David Johns, Ken Martin, "Analog Integrated Circuit Design", John Wiley & sons. 2004
3. Jacob Baker.R.et.al., "CMOS Circuit Design", IEEE Press, Prentice Hall, India, 2000

Suggested Reading:

1. Paul. R. Gray & Robert G. Major, "Analysis and Design of Analog Integrated Circuits", John Wiley & sons. 2004
2. Kang, S. and Leblebici, Y., "CMOS Digital Integrated Circuits, Analysis and Design", TMH, 3rdEdition 2003
3. BehzadRazavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill. 2002

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20ECC203

MICROCONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSORS

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Microprocessor and its interfacing

Course Objectives:
This course aims to:
1. LearnaboutARMMicrocontrollerarchitecturalfeatures
2. UnderstandtheARM'C'Programmingforvariousapplications
3. Study the DSP processor fundamentals and its developmenttools

Course outcomes:
Upon completion of this course, students will be able to:
1. Compare and select ARM processor core based on requirements of embeddedapplication
2. AnalyzevariousfeaturesofARMCortex-M SeriesProcessor
3. AbletointerfacevariousI/OdevicestoARM7microcontrollers.
4. UnderstandthebasicarchitecturalneedsofProgrammableDSPs
5. ApplysmallapplicationsonDSPprocessor-basedplatform

UNIT-I

BackgroundofARMandARMArchitecture:ABriefhistory,Architecture Versions, Registers, pipeline, exception, interrupts and the vector table; core extensions, Introduction to ARM instruction set, Introduction to Thumb instructions,IntroductiontoARMCProgramming.

UNIT-II

LPC21XX Microcontroller: Salient features of LPC 21XX, Pin description, ArchitecturalOverview.Peripherals: DescriptionofGeneral-PurposeInput/Output(GPIO)ports,PincontrolBlock.Features,Pindescription,Registerdescription andoperationofPLL,Timers,PWM,Interfacing:LED,Relay,Buzzer,LCD,DAC,DCmotor.Communicationprotocols:Brie foverviewonI2C,SPIandCAN.

UNIT-III

ARM Cortex-M3 Processor: The Thumb-2 Technology and Instruction Set Architecture,Programmingmodel-Registers,Operationmodes,ExceptionsandInterrupts,VectorTables,MemoryMap,Applications.

UNIT-IV

ProgrammableDSP(P-DSP)Processors: Basicarchitecturalfeatures-VLIWarchitecture,DSPcomputationalbuildingblocks,BusandMemoryarchitecture, Address generation unit, speed issues, Fixed and Floating-point data paths, IntroductiontoTIDSPProcessorfamily.IntroductiontoFPGAbasedDSPsystem design.

TMS320C67XX: Features of C67XX Processors, Internal Architecture, Functional units and operation, Data paths, Cross paths, Control Register File.

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UNIT-V

TMS320C67XX Assembly Language Instructions: Functional Unit and its Instructions, Addressing modes, Fixed point Instructions, Conditional Operations, Parallel Operations, Floating point instructions.

TMS320C67XX Application Development Tools: Code composer studio (CCS), Application programs in C67XX Code development in both C and Assembly language.

Text Books:

1. JosephYiu,"ThedefinitiveguidetoARMCortex-M3",Elsevier,2nd Edition,2010
2. Andrew N. SLOSS, Domonic Symes, Chris Wright "ARM System Developers Guide-Designingand optimizing system software" ELSEVIER1st Edition2004.
3. Avatar Singh and S. Srinivasan, "Digital Signal Processing Implementations Using DSP Microprocessors", Thomson Brooks, 2004.

Suggested Reading:

1. B. Ventakaramani, M. Bhaskar, "Digital Signal Processes, Architecture Processing and Applications", Tata McGraw Hill, 2002.
2. RulphChassing, "Digital Signal Processing and Applications with the C6713 and C6416 DSK" A John Wiley & Sons, Inc., Publications.

20ME M103

RESEARCH METHODOLOGY AND IPR

(Mandatory Course)

Instruction	2L Hours per week
Duration of SEE	2 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Course Objectives:
This course aims to:

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Course Outcomes:
Upon completion of this course, students will be able to:

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT-I

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT-II

Literature Survey Report Writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT-III

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT-IV

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non-parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, F-test, z-test

UNIT-V

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright? How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004

Suggested Reading:

1. AjitParulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd, 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010.

20ECE201

ADVANCED COMPUTER ORGANIZATION

(Program Elective)

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Fundamentals of Computer architecture.

Course Objectives:
This course aims to:
1. Learn about processor design for computer system
2. Understand the memory organization of the computer
3. Study the I/O organization and parallel computer systems

Course Outcomes:
Upon completion of this course, students will be able to:
1. Analyze the computer arithmetic operations.
2. Design of control unit of the computer
3. Understand the memory organization of the computer
4. Interface various I/O modules to the computer system
5. Analyze the multiprocessor environment and various buses for the computer system

UNIT– I:
Processor Design: CPU Organization, Data Representation, Instruction Formats, Data Path Design: Fixed Point Arithmetic and Floating-Point Arithmetic, Instruction Pipelining, Super Scalar techniques, linear pipeline processors, Super scalar and super pipeline design, Multi vector and SIMD computers.

UNIT– II:
Control Unit Design:
Basic Concepts: Basic control unit of the computer system. Hardwired Control Unit Designapproach, Micro-programmed Control Unit- Design Approach, Micro program sequencer, Case studies based on both the approaches.

UNIT – III:
Memory Organization:
Internal memory, computer memory system overview, the memory Hierarchy, Random access memories, Cache memory, Elements of cache design, Virtual memory- protection and examples of virtual memory, Replacement Policies.

UNIT– IV:
I/O Organization: Accessing I/O Devices, Programmed I-O, Interrupts, DMA, Bus Arbitration; Synchronous bus and asynchronous bus, Interface circuits, Parallel port, Serial port, standard I/O interfaces, IO Processor, PCI bus, SCSI bus, USB busprotocols.

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UNIT– V:

Parallel Computer Systems:

Instruction Level Parallelism (ILP) – Concept and Challenges, Dynamic Scheduling, Limitations on ILP, Thread Level Parallelism, Multi-processors – Characteristics, Symmetric and Distributive Shared Memory Architecture, Vector Processors and Supercomputers.

Text Books:

1. Carl Hamacher, Vranesic, Zaky, "Computer Organization", 5thedition, MGH, 2010
2. William Stallings, "Computer Organization and Architecture designing for Performance", 7th edition, PHI, 2007.

Suggested Reading:

1. John L. Hennessy and David A. Patterson, "Computer Architecture", A quantitative Approach, 3rd Edition, Elsevier, 2005.
2. Hayes John P, "Computer Architecture and organization" 3rd Edition, MGH, 1998.

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20ECE213

VLSI TECHNOLOGY AND PHYSICAL DESIGN AUTOMATION

(Program Elective)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Basic knowledge on semiconductor physics and MOS transistors followed by analog and digital Fundamentals is required.

Course Objectives:

This course aims to:

1. Model passive and active devices suiting advances in IC fabrication technology.
2. Create learning, development and testing environment to meet ever challenging needs in the field of Chip Design.
3. Communicate effectively and convey ideas using innovative engineering using appropriate EDA tools

Course outcomes:

Upon completion of this course, students will be able to:

1. Explain various technology aspects of VLSI Physical design.
2. Demonstrate CMOS IC fabrication process.
3. Apply Design rules in the construction of layouts of a given design.
4. Choose appropriate Automation algorithm for partitioning, floor planning, placement and routing.
5. Identify EDA/CAD tools for Automation of VLSI Physical design automation.

UNIT-I

Introduction to VLSI Technology and Fabrication Process: Various layers of IC, Wafer preparation and crystal growth, Oxidation, CVD, Lithography, Etching, Ion implantation, Diffusion techniques.

UNIT-II

Concepts and Scope of Physical Design: Typical structures of passive and active components, CMOS fabrication process- n-Well, P-Well and Twin Tub, CMOS parasitic- Latch-up and its prevention.

UNIT-III

Cell Concepts and Design Rules: Cell based layout design, fabrication errors, alignment sequence and alignment inaccuracy, Interconnects, Contacts, Vias, SCMOS design rules, Lambda based design rules, Stick diagrams, Hierarchical stick diagrams, Layouts.

UNIT-IV

General Purpose Methods for Combinational Optimization: Partitioning, Placement, Discrete methods of global and local placements, Routing, local and Global routing via minimization, Over the cell routing, Single layer and two-layer routing, Clock and power routing.

UNIT-V

EDA/CAD Tools: Layout editors, Circuit extractors, Automatic layout tools, Modeling and extraction of circuit Parameters from physical layout, Compaction algorithms, physical automations of FPGAs.

Text Books:

1. J.D.Plummer, M.D.Deal and P.B.Griffin, "The Silicon VLSI Technology Fundamentals", Practice and modeling, Pearson Education 2009.
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", 2002.

Suggested Reading:

1. Modern VLSI Design (System on Chip), Woyne Wolf, Pearson Education, 2002.
2. S.H. Gerez, "Algorithms for VLSI Design Automation", 1998.

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20EG A101

ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course)

Instruction	2L Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	--
Credits	Non-Credit

Course Objectives:

This course aims to:

1. To the various purposes of Research Papers and help them infer the benefits and limitations of research.
2. To developing the content, formulating a structure and illustrating the format of writing a research paper.
3. In differentiating between qualitative and quantitative research types.
4. To constructing paragraphs and developing thesis statement.
5. To producing original research papers while avoiding plagiarism.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Illustrate the nuances of research paper writing and draw conclusions about the benefits and limitations of research.
2. Classify different types of research papers and organize the format and citation of sources.
3. Review the literature and categorize between different types of research.
4. Draft paragraphs and write thesis statement in a scientific manner.
5. Develop an original research paper while acquiring the knowledge of how and where to publish their papers.

UNIT-I

Academic Writing

Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT-II

Research Paper Format

Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT-III

Research Methodology

Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT-IV

Process of Writing a Research Paper

Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft–Revising/Editing - The final draft and proof reading. IEEE Style.

UNIT-V

Research Paper Publication

Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits

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Text Book:

1. C. R Kothari, Gaurav, Garg, Research Methodology Methods and Techniques, New Age International Publishers. 4th Edition.

Suggested Reading:

1. Day R, "How to Write and Publish a Scientific Paper", Cambridge University Press, 2006.
2. MLA "Hand book for writers of Research Papers", East West Press Pvt. Ltd, New Delhi, 7th Edition.
3. Lipson, Charles (2011), Cite Right: A Quick Guide to Citation Styles; MLA, APA, Chicago, The Sciences, Professions, and more (2nd Edition). Chicago [u.a] : Univ of Chicago Press.

Online Resources:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. NPTEL: https://nptel.ac.in/courses/121/106/121106007/
3. https://www.classcentral.com/course/swayam-introduction-to-research-5221

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20ECC205

ANALOG AND DIGITAL CMOS VLSI DESIGN LAB

Instruction	4P Hours per week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Pre-requisites: Analog and Digital design concepts.

Course Objectives:
This course aims to:
1. Understand Characteristics behavior of MOSFET.
2. Analyze performance of Differential amplifiers
3. Verify layout of basic digital circuits

Course Outcomes:
Upon completion of this course, students will be able to:
1. Verify the characteristics of MOSFET and design entry in the tool.
2. Understand and evaluate the design specs and library files of tool.
3. Apply the concept of theory and design in the lab implementation.
4. Analyze and calculation, power and delay from the graphs.
5. Compare performance of different circuits with the simulation results.

List of Experiments:

1. Characteristics of MOSFET.
2. Calculation of rise time and fall time for CMOS inverter.
3. To build a three stage and five stage ring oscillator circuit in 0.18um and 0.13um technology and compare its frequencies and time period.
4. NMOS Common Source Amplifier.
5. Design of Differential Amplifier.
6. Design of Operational Amplifier.
7. Draw the layout of Inverter Circuit.

Suggested Reading:

1. Cadence Design Systems (Ireland) Ltd., “Cadence manual”, 2013.

20ECC206

MICROCONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSORS LAB

Instruction	4P Hours per week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Prerequisite: Programming in'C' and basics of ARM Microcontroller.

Course Objectives:
This course aims to:
1. Write the ARM 'C' programming for applications
2. Understand the interfacing of various modules with ARM 7/ ARM Cortex-M3
3. Develop assembly and C Programming for DSP processors

Course Outcomes:
Upon completion of this course, students will be able to:
1. Install, configure and utilize tool sets for developing applications based on ARM processorcore.
2. DesignanddeveloptheARM7 basedembeddedsystemsforvarious applications.
3. DevelopapplicationprogramsonARMandDSPdevelopmentboards both in assembly and C.
4. DesignandImplementthedigitalfiltersonDSP6713processor.
5. Analyze the hardware and software interaction andintegration.

List of Assignments:

Part A

ExperimentstobecarriedoutonARM7/Cortex-M 3 developmentboards

1. BlinkanLEDwithsoftwaredelay,delaygeneratedusingtheSysTicktimer.
2. Systemclockreal-timealterationusingthePLLmodules.
3. ControlintensityofanLEDusingPWMimplementedinsoftwareandhardware.
4. ControlanLEDusingswitchbypollingmethod,byinterruptmethod and flash the LED once every five switchpresses.
5. UART EchoTest.
6. Take analog readings on rotation of rotary potentiometer connected to an ADCchannel.
7. TemperatureindicationonanRGBLED.
8. Mimic light intensity sensed by the light sensor by varying the blinkingrateofanLED.
9. Evaluate the various sleep modes by putting core in sleep and deep sleep modes.
10. System reset using watchdog timer in case something goeswrong.
11. Sample soundusingamicro-phoneanddisplaysoundlevelsonLEDs.

20ECC202

EMBEDDED SYSTEM DESIGN USING RTOS

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisites: The prior knowledge on the basics of operating systems.

Course Objectives:
This course aims to:
1. Understand the basic concepts of the UNIX operating system and POSIX Standards.
2. Know the importance of hard/soft Real-Time Systems and to familiarize the cases for tasks, semaphores, queues, pipes, and event flags.
3. Study the basics of the kernel objects and memory management in VxWorks and to know about real-time applications development tools.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the concepts of UNIX operating system and process management.
2. Describe the POSIX standards for real time systems and compare hard and soft real time systems.
3. Analyze various scheduling algorithms and application to real time systems.
4. Illustrate the concepts of real time operating system and VxWorks.
5. Elucidate the concepts software development tools and RTOS comparison.

UNIT-I:
Brief Review of UNIX Operating Systems: UNIX Kernel File system concepts of Process Concurrent Execution &Interrupts. Process management – forks & execution. Programming with system calls, Process Scheduling, Shell programming and filters.Portable Operating system Interface (POSIX) IEEE Standard 1003.13 & POSIX real time profile. POSIX versus traditional Unix Signals.Overheads and timing predictability.

UNIT-II:
Hard versus Soft Real-time systems: Examples, Jobs & Processors, Hard and Soft timing constraints, Hard Real –time systems, SoftReal time systems. Classical Uniprocessor Scheduling algorithms –RMS, Preemptive EDF, Allowing for Preemptive and Exclusion condition.

UNIT-III:
Concept of Embedded operating systems, Differences between Traditional OS and RTOS, Real time system concepts, RTOS Kernel & Issues in Multitasking Task Assignment, Task switching, Foreground ISRs and Background Tasks, critical section, Reentrant Functions, Inter-process Communication (IPC)- IPC through Semaphores, Mutex, Mailboxes, Message queues or pipes and Event Flags.

UNIT-IV:
VxWorks –POSIX Real Time Extensions, timeout features, Task Creation, Semaphores (Binary, Counting), Mutex, Mailbox, Message Queues, Memory Management – Virtual to Physical Address Mapping.

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UNIT-V:

Debugging tools and cross development environment, Software Logic analyzer, ICEs. Comparison of RTOS – VxWorks, μC/OS-II and RT Linux for Embedded Applications.

Text Books:

1. Jane W.S.Liu,"Real Time Systems", Pearson Education, Asia, 2001.
2. Wind River Systems, "VxWorks Programrs Guide", Wind River Systems Inc.1997.
3. Jean. J. Labrose, "MicroC/OS-II", The CMP Books, 2002.

Suggested Reading:

1. Betchof, D.R., "Programming with POSIX threads", Addison Wesley Longman, 1997.
2. C.M.Krishna and G.Shin, "Real Time Systems", McGraw-Hill Companies Inc., McGraw Hill International Editions, 1997

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20EC C204

VLSI DESIGN VERIFICATION AND TESTING

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Pre-requisite: Knowledge on Analog and Digital CMOS VLSI Design, C and C++ Language concepts.

Course Objectives:
This course aims to:
1. The concepts of verification and testing.
2. Data types and OOPs concepts.
3. Randomization in System Verilog.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Recipe of front-end design verification techniques and create reusable test bench environments.
2. Understanding various data types used in System Verilog
3. Demonstrating OOPs concepts to System Verilog verification
4. Application of Randomization concept in System Verilog
5. Interface a System Verilog testbench with System C

UNIT-I
Verification Guidelines: Verification Process, Basic test bench functionality, directed testing, Methodology basics, Constrained-Random stimulus, Functional coverage, test bench components, Layered test bench, Building layered test bench, Simulation environment phases, Maximum code reuse, test bench performance.

UNIT-II
Data Types: Built-in data types, Fixed-size arrays, Dynamic arrays, Queues, Associative Arrays, Linked lists, Array methods, choosing a storage type, creating new types with typedef, Creating user-defined structures, Type conversion, Enumerated types, Constants strings, Expression width. Procedural statements and routines: Procedural statements, tasks, functions and void functions, Routine arguments, returning from a routine, local data storage, Time values.

UNIT-III
Basic OOPS: Introduction, think of nouns, not verbs, your first class, where to define a class, OOP terminology, creating new objects, Object de-allocation, using objects, Static variables vs. Global variables, Class methods, defining methods outside of the class, scoping rules, Using one class inside another.

UNIT-IV
Connecting the test bench and design: Separating the test bench and design, Interface constructs, Stimulus timing, Interface driving and sampling, connecting it all together, Top-level scope Program Module interactions. System Verilog Assertions, understanding dynamic objects, copying objects, Public vs. Local, straying off course building a test bench.

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UNIT-V

Randomization: Introduction, What to randomize, Randomization in System Verilog, Constraint details solution probabilities, Controlling multiple constraint blocks, Valid constraints, In-line constraints, The pre randomize and post randomize functions, Random number functions, Constraints tips and techniques, Common randomization problems, Iterative and array constraints, Atomic stimulus generation vs. Scenario generation, Random control, Random number generators, Random device configuration.

Text Books:

1. Chris Spears, "System Verilog for Verification", Springer, 2nd Edition 2006.
2. M. Bushnell and V. D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers 2002.

Suggested Reading:

1. Writing test benches using System Verilog By Janick Bergeron Edition: illustrated Published by Birkhäuser, 2006 ISBN 0387292217, 9780387292212
2. System Verilog for Verification: A Guide to Learning the Test bench Language Features by Chris Spear Edition: 2, Published by Springer, 2008 ISBN 0387765298, 9780387765297

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20EC E205

LOW POWER VLSI DESIGN

(Program Elective)

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Pre-requisites: Students should have prior knowledge of Analog and Digital CMOS VLSI Design.

Course Objectives:

This course aims to:

1. Know the sources of power dissipation and need for low power designs for emerging technologies.
2. Understand the concepts of Low power design techniques for digital circuits.
3. Analyze the power dissipations of memory and processor systems and able to adopt suitable methods for power reduction.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Identify sources of power dissipation in a given VLSI Circuit
2. Analyze and apply various low power circuit techniques for combinational and sequential circuits
3. Demonstrate understanding of clock distribution for Low Power
4. Explain power minimization techniques for arithmetic and memory subsystem
5. Elaborate Microprocessor Design System concepts for Low Power

UNIT-I:

Technology & Circuit Design Levels: Sources of power dissipation in digital ICs, degree of freedom, recurring themes in low-power, emerging low power approaches, dynamic dissipation in CMOS, effects of V_{dd}&V_t on speed, constraints on Vt reduction, transistor sizing & optimal gate oxide thickness, impact of technology scaling, technology innovations.

UNIT-II:

Low Power Circuit Techniques: Power consumption in circuits, flip-flops & latches, high capacitance nodes, energy recovery, reversible pipelines, high performance approaches.

UNIT-III:

Low Power Clock Distribution: Power dissipation in clock distribution, single driver Versus distributed buffers, buffers & device sizing under process variations, zero skew vs Tolerable skew, chip & package co-design of clock network.

UNIT-IV:

Logic Synthesis for Low Power estimation techniques: Power minimization techniques, Low power arithmetic components-circuit design styles, adders, multipliers. Low Power Memory Design: Sources & reduction of power dissipation in memory subsystem, sources of power dissipation in DRAM & SRAM.

UNIT-V:

Low Power Microprocessor Design System: power management support, architectural tradeoffs for power, choosing the supply voltage, low-power clocking, implementation problem for low power, comparison of microprocessors for power & performance.

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Text Books:

1. Jan M. Rabaey and MassoudPedram, “Low Power Design Methodologies”, Kluwer Academic, 1996
2. Kaushik Roy, Sharat Prasad, “Low power CMOS VLSI circuit design”, John Wiley sons, Inc., 2000.

Suggested Reading:

1. J.B.Kulo and J.H Lou, “Low voltage CMOS VLSI Circuits”, Wiley, 1999.
2. Gary Yeap, “Practical low power digital VLSI design”, Kluwer, 1998.
3. A.P.Chandrasekaran and R.W.Broadersen, “Low power digital CMOS design”, Kluwer,1995

20EC E210

SOC DESIGN

(Program Elective)

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Pre-requisites: Concept of Embedded Systems, Microprocessors, microcontrollers and ASIC.

Course Objectives:
This course aims to:

1. Introduce students to various approaches of SoC design, ADLs and GNR.
2. Introduce various techniques used for Low power SoC Design
3. Demonstrate various simulation methods and synthesis techniques for SoCs.

Course Outcomes:
Upon completion of this course, students will be able to:

1. Understand the conceptsrelated to SoC like NISC, ASIP, ADL, GNR, Reconfiguration, Clock Gating, DVS etc.
2. Differentiate between various design strategies like ASIC and SOC etc.
3. Distinguish between various types of Processors like CISC, RISC, NISC and ASIP.HDL and ADL
4. Design a simple SOC for reconfigurability / low power / ASIP / NISC etc. and synthesize simple blocks using Graph Theory.
5. Simulate and synthesize the Design using various simulation models.

UNIT 1

ASIC and NISC Overview: Overview-Overview of ASIC types, design strategies, CISC, RISC and NISC approaches for SOC architectural issues and its impact on SoC design methodologies, Application Specific Instruction Processor (ASIP) concepts, NISC-NISC Control Words methodology, NISC Applications and Advantages.

UNIT 2

ADL (for ASIP&NISC) and GNR: Architecture Description Languages (ADL) for design and verification of Application Specific Instruction-set Processors (ASIP), NISC-design flow, modeling NISC architectures and systems,

Generic Netlist Representation -A formal language for specification, compilation and synthesis of embedded processors.

UNIT 3

Low power SoC design: Low power SoC design / Digital system, Low power system perspective-power gating, clock gating, adaptive voltage scaling (AVS), Static voltage scaling, Dynamic clock frequency and voltage scaling (DCFS), building block optimization, power down techniques, power consumption verification.

UNIT 4

Simulation: Different simulation modes, behavioral, functional, static timing, gate level,switch level, transistor/circuit simulation, design of verification vectors.FPGA, Reconfigurable systems, SoC related modeling of data path design and control logic, Minimization of interconnects impact, clock tree design issues.

UNIT 5

Synthesis: Role and Concept of graph theory and its relevance to synthesizable constructs, Walks, trails paths, connectivity, components, mapping/visualization, nodal and admittance graph. Technology independent and technology dependent approaches for synthesis, optimization constraints, Synthesis report analysis. HDL coding techniques for minimization of power consumption.Designof NISC for DCT application.

Text Books:

1. Michael J. Flynn and Wayne Luk, "Computer System Design: Systemon-Chip". Wiley, 2011.
2. B. Al Hashimi, "System on chip-Next generation electronics", The IET, 2006.

Suggested Reading:

1. Hubert Kaeslin, "Digital Integrated Circuit Design: From VLSI Architectures to CMOS Fabrication", CambridgeUniversity Press, 2008.
2. RochitRajsuman, "System-on- a-chip: Design and test", Advantest America R & D Center, 2000.
3. P Mishra and N Dutt, "Processor Description Languages", Morgan Kaufmann, 2008

20EC A101

VALUE EDUCATION
(Audit Course)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	--
Credits	Non-Credit

Course Objectives:
This course aims to
1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Course outcomes:
After completion of the Course, Students will be able to
1. Summarize classification of values and values for self-development.
2. Identify the importance of values in personal and professional life.
3. Apply the importance of social values for better career and relationships.
4. Compile the values from holy books for personal and social responsibility.
5. Discuss concept of soul and reincarnation, values Dharma, Karma and Guna.

UNIT-I
Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behavior, standards and principles based on religion, culture and tradition.

UNIT-II
Value Cultivation, and Self-Management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III
Spiritual Outlook and Social Values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labor, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV
Values in Holy Books **:** Self-management and Good health; **and internal & external Cleanliness,** Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V
Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasic gunas.

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Text Books:

1. Chakroborty, S.K. “Values & Ethics for organizations Theory and practice”, Oxford University Press, New Delhi, 1998.
2. Jaya DayalGoyandaka, “Srimad Bhagavad Gita”, withSanskrit Text, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.

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20ECC207

RTL SIMULATION AND SYNTHESIS WITH PLDs LAB

Instruction	4P Hours per week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Pre-requisites: Digital Design and Verilog HDL programming skills.

Course Objectives:
This course aims to:
1. The simulation of combinational and sequential circuits.
2. FSM based designs.
3. Implementation of DFT and FFTs.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Demonstrate the process steps required for simulation /synthesis.
2. Design and simulate various combinational and sequential circuits using HDL.
3. Develop an RTL code for various real time applications.
4. Synthesize an RTL code for several digital designs.
5. Build a prototype for various digital circuits with PLDs.

Design entry by Verilog, Programmable Logic Devices, Introduction to ASIC Design Flow, FPGA, SoC, Floor planning, Placement, Clock tree synthesis, Routing, Physical verification, Power analysis, ESD protection. Static Timing analysis, Meta-stability, Clock issues, Need and design strategies for multi-clock domain designs, IP and Prototyping, Design for testability.

List of Experiments:

1. Verilog implementation of 8:1 Mux/Demux, Full Adder, 8-bit Magnitude comparator,
2. Encoder/decoder, Priority encoder, D-FF, 4-bit Shift registers (SISO, SIPO, PISO, Bidirectional) 3-bit Synchronous Counters, Binary to Gray converter, Parity generator.
3. Sequence generator/detectors, Synchronous FSM – Mealy and Moore machines.
4. Vending machines - Traffic Light controller, ATM, elevator control.
5. PCI Bus & arbiter and downloading on FPGA.
6. UART/ USART implementation in Verilog.
7. Realization of single port SRAM in Verilog.
8. Verilog implementation of Arithmetic circuits like serial adder/subtractor, parallel adder/subtractor, serial/parallel multiplier.
9. Discrete Fourier transform/Fast Fourier Transform algorithm in Verilog.

Suggested Reading:

1. Samir Palnitkar, "Verilog HDL, a guide to digital design and synthesis", Prentice Hall 2003.
2. Doug Amos, Austin Lesea, Rene Richter, "FPGA based prototyping methodology manual", Xilinx, 2011.
3. Bob Zeidman, "Designing with FPGAs & CPLDs", CMP Books, 2002.

20ECC208

RTOS AND VLSI DESIGN VERIFICATION LAB

Instruction	4P Hours per week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Pre-requisites: Basics of operating system,basics of embedded systemand verification concepts.

Course Objectives:
This course aims to:
1. Understand the concepts of RTOs
2. Illustrate the concept of task scheduling
3. Verify layout of basic digital circuits

Course Outcomes:
Upon completion of this course, students will be able to:
1. Verify a few important OOPs concepts
2. Compile and Run various design constructs using CAD tool
3. Develop self-checking test benches using SystemVerilog
4. Understand the programming concepts of RTOS
5. Analyze Multitasking, IPC and scheduling concepts

RTOS programming:

1. Introduction to RTOS (VxWorks) and its basic functions
2. RTOS Timer programming (VxWorks)
3. RTOS Task function programming (VxWorks)
4. Multitasking using round robin scheduling
5. IPC using message queues
6. IPC using semaphore
7. IPC using mail box
8.

Verification (Mentor Graphics Tools)

1. Sparse memory
2. Semaphore
3. Mail box
4. Classes
5. Polymorphism
6. Coverage
7. Assertions

Suggested reading:

1. Silberschatz, Galvin, Gange"Operating Systems Concepts" 8/e , Wiley Education, 2007.
2. Wind River Systems Inc., "VxWorks Programmers Guide", 1997.

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20EC C209

MINI PROJECT WITH SEMINAR

Instruction	4 P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Prerequisite: Knowledge of preparing slides by using power point presentations, Capable of searching for suitable literature and Presentation skills.

Course Objectives:
This course aims to:
1. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and references.
2. To expose and practice of searching and referring the required literature.
3. This is expected to provide a good initiation for the student(s) towards R&D.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Familiarize in searching the suitable literature in the chosen field.
2. Develop skills to understand and summarize the contents from the literature.
3. Ability to synthesize knowledge/ skills previously gained and applied in execution of a chosen technical problem.
4. Enhance oral presentation skills through power point presentations.
5. Learn and present the findings of their technical solution in a written report.

Guidelines:
1. As part of the curriculum in the II - Semester of the Program each student shalldo a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
2. Each student will be allotted to a faculty supervisor for mentoring.
3. Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
4. Mini projects shall have inter-disciplinary/ industry relevance.
5. The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
6. All the investigations are clearly stated and documented with the reasons/explanations.
7. The mini project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and references.

Departmental committee: Supervisor and two faculty coordinators

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Guidelines for awardingmarks in CIE: Max. Marks: 50		
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Departmental Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

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19EC E204

FPGA AND CPLD ARCHITECTURES

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of Digital design using Multiplexers and Look-up tables.

Course Objectives: This course aims to:

1. Study various PLD, CPLDs and FPGA Architectures and its features.
2. Understand the different programming technologies, placement and routing
3. Study the design tools for FPGA and ASICs.

Course Outcomes: Upon completion of this course, students will be able to:

1. Explain the concepts of PLDs, CPLDs and FPGAs.
2. Analyze and compare the various architectures of CPLD and FPGA and its programming technologies.
3. Implement various logic functions on PLDs, CPLDs and FPGAs.
4. Understand the concepts of placement and routing algorithms and classifying ASICs.
5. Demonstrate VLSI tool flow for CPLDs and FPGAs.

UNIT-I

Programmable Logic Devices: Introduction, Evolution: Programmable read only memory (PROM), programmable logic array (PLA) and programmable array logic (PAL). Implementation with PLDs.Programming technologies. Design flow for CPLDs & FPGAs.

UNIT-II

CPLDs: Complex Programmable Logic Devices: Architecture and features of Altera max 7000 series CPLD, AMD Mach 4 and Xilinx 9500 series.

FPGAs: Field Programmable Gate Arrays: Logic blocks, routing architecture and features of Xilinx XC4000, Spartan II, Virtex II and Actel Act1, Act2, Act3 FPGAs.

UNIT-III

Advance FPGAs: Architectures and Features of Xilinx Spartan- 6, Virtex-6, and AlterasStartix FPGAs. Introduction to Xilinx Zynq board.

UNIT-IV

Placement: objectives, placement algorithms: Min-cut-Based placement, Iterative Improvement placement, Simulated Annealing.Routing: objectives, Segmented Channel Routing, Maze Routing, Routability estimation, computing signal delay in RC tree networks.

UNIT-V

Digital Front End and back End tools for FPGAs and ASICs, FPGA implementation steps.Verification: introduction, logic simulation, design validation, timing verification.Testing concepts: failures, mechanisms and faults, fault coverage, ATPG methods and programmability failures.

Text Books:

1. S. Brown, R. Francis, J. Rose, Z.Vransic, “Field Programmable Gate array”, BSP,2007.
2. P.K. Chan & S. Mourad, “Digital Design Using Field Programmable Gate Array”, Pearson Education 2009.

Suggested Reading:

S. Trimberger, Edr., “Field Programmable Gate Array Technology”, Kluwer Academic Publications, 1994.

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19CE O101

COST MANAGEMENT OF ENGINEERING PROJECTS
(Open Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:
1. Enable the students to understand the concepts of Project management.
2. Provide knowledge on concepts of Project Planning and scheduling.
3. Create an awareness on Project Monitoring and Cost Analysis
4. Provide adequate knowledge to the students on Recourse Management Costing-Variance Analysis
5. Train the students with the concepts of Budgetary Control for cost management and to provide basic platform on Quantitative techniques for cost management.

Course Outcomes: Upon completing this course, students will be able to:
1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
2. Determine the critical path of a typical project using CPM and PERT techniques.
3. Prepare a work break down plan and perform linear scheduling using various methods.
4. Solve problems of resource scheduling and levelling using network diagrams.
5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.

UNIT-I

Project Management: Introduction to project managements, stakeholders, roles, responsibilities and functional relationships. Principles of project management, objectives and project management system. Project team, organization, roles, responsibilities. Concepts of project planning, monitoring, staffing, scheduling and controlling.

UNIT-II

Project Planning and Scheduling: Introduction for project planning, defining activities and their interdependency, time and resource estimation. Work break down structure. Linear scheduling methods-bar charts, Line of Balance (LOB), their limitations. Principles, definitions of network-based scheduling methods: CPM, PERT. Network representation, network analysis-forward and backward passes.

UNIT-III

Project Monitoring and Cost Analysis: introduction-Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making, Time cost tradeoff-Crashing project schedules, its impact on time on time, cost. Project direct and indirect costs.

UNIT-IV

Resources Management and Costing-Variance Analysis: Planning, Enterprise Resource Planning, Resource scheduling and levelling. Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis

Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement

UNIT-V

Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative Techniques for Cost Management: Linear Programming, PERT/ CPM, Transportation Assignment problems, Simulation, Learning Curve Theory.

Text Books:

1. Charles T Horngren "Cost Accounting A Managerial Emphasis", Pearson Education; 14th edition 2012,
2. Charles T. Horngren and George Foster, "Advanced Management Accounting" Prentice-Hall; 6th Revised edition, 1987
3. Robert S Kaplan Anthony A. Atkinson, "Management & Cost Accounting" , Pearson; 2nd edition, 1996
4. K. K Chitkara, "Construction Project Management: Planning, scheduling and controlling", Tata McGraw-Hill Education. 2004.
5. Kumar Neeraj Jha "Construction Project Management Theory and Practice", Pearson Education India; 2nd edition, 2015.

19EC C210

DISSERTATION / PHASE - I

Instruction	20 P Hours per Week
Duration of SEE	—
SEE	—
CIE	100 Marks
Credits	10

Course Outcomes: At the end of the course:

1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, National/ International refereed journals and contact resource persons for the selected topic of research.
3. Students will learn to write technical reports.
4. Students will develop oral and written communication skills to present.
5. Student will defend their work in front of technically qualified audience.

Guidelines:

1. The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.
2. Seminar should be based on the area in which the candidate has undertaken the dissertation work.
3. The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.
4. The preliminary results (if available) of the problem may also be discussed in the report.
5. The work has to be presented in front of the committee consists of Head, Chairperson-BoS, Supervisor and Project coordinator.
6. The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

HEAD
DEPARTMENT OF ECE
Chaitanya Bharathi Institute of Technology
Hyderabad-500 075

Guidelines for the award of Marks:		Max. Marks: 100
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

Note : Department committee has to assess the progress of the student for every two weeks.

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19EC C211

DISSERTATION / PHASE - II

Instruction	32 P Hours per Week
Duration of SEE	Viva - Voce
SEE	100 Marks
CIE	100 Marks
Credits	16

Course Outcomes: At the end of the course:

1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
2. Students will be able to design and develop an experimental set up/ equipment/test rig.
3. Students will be able to conduct tests on existing set ups/equipment and draw logical conclusions from the results after analyzing them.
4. Students will be able to either work in a research environment or in an industrial environment.
5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

Guidelines:

1. It is a continuation of Project work started in semester III.
2. The student has to submit the report in prescribed format and also present a seminar.
3. The dissertation should be presented in standard format as provided by the department.
4. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.
5. The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner (HoD and BoS Chair Person) guide/co-guide.
6. The candidate has to be in regular contact with his/her guide/co-guide.

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Chaitanya Bharathi Institute of Technolog
Hyderabad-500 075

Guidelines for awarding marks in CIE:		Max. Marks: 100
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	10	Review 2
	10	Review 3
	15	Final presentation with the draft copy of the report reportstandard format
	10	Submission of the report in a standard format
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Analytical / Programming / Experimental Skills Preparation
	10	Report preparation in a standard format

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
External and Internal Examiner(s) together	20	Power Point Presentation
	40	Quality of thesis and evaluation
	20	Quality of the project ● Innovations ● Applications ● Live Research Projects ● Scope for future study ● Application to society
	20	Viva-Voce

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20MBO201

E-BUSINESS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide the basics of Electronic Commerce and understand Mobile Commerce Market.
2. To educate on the Current and emerging Business Models.
3. To focus on the need for security in e-commerce and to know various types of e-services.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand various concepts and developments of Physical, E-Commerce and M-Commerce.
2. Develop various models of E-commerce to gain Competitive Advantage.
3. Design and use appropriate Electronic Payment Systems.
4. Apply appropriate Network Security and Firewalls in E-Business activities.
5. Understand various types of e-services and Legal, Ethical and privacy issues associated with E-Business.

Unit I Introduction

Electronic Commerce and Physical Commerce, The Digital phenomenon, Different types of e-commerce Electronic Commerce Framework, Advantage and Disadvantages of e-commerce, Growth of the Internet, Emergence of the World Wide Web, Transition to e-commerce in India, e-commerce Opportunities for Industries. Mobile Commerce - Overview of the Market and Leveraging Applications.

Unit II Consumer and Business-Oriented e-commerce

Consumer-Oriented e-commerce: Traditional retailing, e-retailing, benefits and features of e-retailing, Key success factors, Models of e retailing. Developing a Consumer-oriented e-commerce system: The emergent Business Model as the basis of e-commerce system development. Process-oriented e-commerce Development approach. Steps in the Development methodology. The PASS Model. Business-oriented e-commerce - Features of B2B e-commerce, Business Models.

Unit III Electronic Payment Systems

Introduction to Payment Systems, Electronic Cash: Blind signature, Payment by e-cash over the Internet. Smart Cards and Electronic Payment Systems, e-check: Deposit-and-Clear, Cash-and-Transfer, Lockbox, Direct fund transfer. Risks associated in Electronic Payment Systems. Designing electronic Payment systems.

Unit IV Network Security and Firewalls

Client-Server Network Security, Emerging Client-server Security threats, Firewalls and Network Security, Data and Message security, Encrypted documents and Electronic mail. Digital Signatures, Security Protocols for Web Commerce.

Unit V E-Services and Legal and Privacy Issues

Categories of E-services, Web-enabled services, E-banking, E-stock trading, E-investing, E-education. Match making services: Travel services, E-employment, E-jobs. Information selling on the Web, E-entertainment. Auctions and other specialized services: C2C auction sites and B2B auctions.

Legal, Ethics and Privacy issues- Protection needs and methodology- Consumer protection, Cyber laws, Contracts and Warranties, Taxation and Encryption policies.

Text Books:

1. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, "E Commerce: Fundamentals and Applications", 1st edition, Wiley, 2007.
2. Ravi Kalakota, Andrew B. Whinston, "Frontiers of Electronic Commerce", Pearson, 2011.
3. P.T. Joseph, S.J. "E-Commerce: An Indian Perspective", PHI Learning, 5th edition, 2015.
4. Bharat Bhasker, Electronic Commerce - Framework, Technologies and Applications, 4th edition McGraw Hill Education, 2017.

Suggested Readings:

1. David Whiteley, "E-Commerce: Strategy, Technologies and Applications, 1st edition, McGraw Hill Education, 2017.
2. Harvey M.Deitel, Paul J.Deitel, Kate Steinbuhler, e-business and ecommerce for managers, Pearson, 2011.
3. Laudon and Traver, "E-Commerce: Business, technology and Society", 13th edition, Pearson education, 2018.
4. Sanjay Mohapatra, "E-Commerce Strategy- Text and Cases", 1st edition, Springer US, 2013.
5. Dayle M. Smith, "The E-Business Book: A Step by Step Guide to E-Commerce and Beyond" 1st edition, Bloomberg Press, 2001.
6. Janice Reynolds, "The complete E-commerce Book", 2nd edition, CRC Press, 2004.

CORE COURSES

20MBC101

MANAGEMENT AND ORGANIZATION BEHAVIOUR

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of this Course are:

1. To familiarize with the Fundamental principles of Management practice with emphasis on the roles and functions of Managers and to focus on the critical and challenging areas of Organizational Planning and Organizing.
2. To describe Motivation, Leadership, Communication and Controlling and to provide knowledge of Organization Behaviour concepts to understand and analyze how Organizations and the People within them work.
3. To understand the Nature of Power, Politics, Conflict, and the Negotiation process.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Practice the process of Management's functions and understand how Management Evolution affects future Managers.
2. Analyze the need of Planning and Decision Making and also assess the elements of Organizational structure and evaluate their impact on Employees.
3. Evaluate Motivational strategies, Leadership styles, Communication and Controlling processes used in a variety of Organizational settings.
4. Apply Organization Behaviour Concepts to real-world problems faced by Managers.
5. Evaluate how the Power and Politics help an organization, Sources of Conflict in an Organizational setting and execute the Negotiation process to manage Conflicts and resolve disputes.

UNIT-I Introduction to Management

Management- Definition, Nature, Purpose, Evolution of Management Thought-Scientific Management, Administrative Theory, Human Relations Approach, Hawthorne experiments, Theory X, Theory Y and Theory Z, Behavioural Approach, Systems Theory. Managerial Roles, Managerial Levels, Managerial Skills, Functions of Management, Administration vs. Management, Contemporary Management Issues and Challenges.

UNIT-II Planning and Organizing

Planning – Nature, Purpose, Process, Types of Plans, Management by Objectives (MBO). Decision Making – Types of Decisions, Decision Making Process, Decision Making under Certainty, Uncertainty and Risk. Organizing – Formal and Informal Organization, Process, Types of Organization structures, Line and Staff concepts, Span of Management – Factors, Delegation of Authority, Decentralization.

UNIT-III Leading and Controlling

Motivation- Early and Contemporary Theories of Motivation. Leadership - Leadership Behaviour and Styles. Communication - Purpose, Process, Barriers in Communication, Overcoming barriers to communication. Controlling- Basic Control Process, Critical Control Points, Standards, and Benchmarking, Control as a Feedback System, Requirements for effective controls.

UNIT-IV Organization Behaviour

Organization Behaviour – Nature, Levels, Challenges. Individuals in Organizations - Personality and Ability. Personality - Determinants, Personality and Situation, Big Five Model of Personality, Other Organizationally

Relevant Personality Traits. Ability - Cognitive Ability. Physical Ability, Emotional Intelligence. Nature. Perception - Nature, Characteristics of Perceiver, Target and Situation, Biases and Problems in Person Perception. Group Dynamics and Teams- Types of Work Groups, Group Development, Characteristics of Work Groups, Effective Work Groups and Teams.

UNIT-V Conflict and Negotiations

Nature of Power and Politics, Sources of Individual Power, Functional and Divisional Power. Organizational Politics - The use of Power. Organizational Conflict - Sources, Pondy's Model of Organizational Conflict, Negotiation: Resolving Conflict - Individual level conflict, Group level conflict and promoting Compromise.

Text Books:

1. Harold Koontz and Heinz Weihrich, "Essentials of management: An International & Leadership Perspective", 9th edition, Tata McGraw-Hill Education, 2012.
2. Charles W.L Hill and Steven L McShane, "Principles of Management", Special Indian Edition, McGraw Hill Education, 2007.
3. Jennifer George and Gareth Jones "Understanding and Managing Organizational Behavior", 6th Ed., Pearson Education Inc., 2012.
4. John Schermerhorn, Jr., James G. Hunt and Richard N. Osborn, "Organizational behaviour",10t edition, Wiley India Edition, 2009.

Suggested Readings:

1. Andrew J. Dubrin, "Essentials of Management", 9th Ed., Thomson Southwestern, 2012.
2. Stephen A Robbins, David A. Decenzo and Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
3. Jon L Pierce and Donald G. Gardner, "Management and Organizational behavior", Cengage Learning India (P) Limited, 2001.
4. Richard Pettinger, "Organizational Behaviour", Routledge, 2013.
5. K. Aswathappa, "Organizational behavior", Himalaya Publishing House, 2013.

20MBC102

MANAGERIAL ECONOMICS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To enable the Students to understand the basic Economic concepts, Demand and Supply functions in Decision-making.
2. To understand various Production and Cost functions and choose the optimal combination of Input factors.
3. To understand Price Output determination under different Market structures.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Comprehend and apply the basic Concepts and Economic principles in Decision-making.
2. Calculate Demand Elasticity from Demand Equations.
3. Analyze and Select the Least Cost combination of inputs through Production Function.
4. Examine the different Cost concepts and predict breakeven point.
5. Compare and Contrast the market structures and also Apply Pricing decisions across Industries.

Unit-I Introduction

Nature and Scope of Managerial Economics, Definition, Relation with other Disciplines, Fundamental Concepts of Managerial Economics - Opportunity Cost, Discounting Principle, Time Perspective, Incremental Cost/Reasoning, Equi-Marginal Concept. Objectives of Firm - Profit Maximization Theory, Profit Maximization by Total Revenue and Total Cost Approach, Baumol's Sales Revenue Maximization, Simon's Model of Satisfying Behaviour, Berle-Means-Galbraith Model of Corporate Power Structure, Penrose's Theory of Firm, Optimization Techniques.

Unit-II Demand and Supply Analysis

Theory of Demand, Demand Function, Law of Demand, Elasticity of Demand, Types and Significance of Elasticity of Demand, Demand Estimation – Market Research Approaches, Need for Forecasting and Forecasting Techniques, Supply Function, Law of Supply, Elasticity of Supply.

Unit-III Production Analysis

Production Function - Law of Variable Proportions, Isoquants, Returns to Scale, Cobb Douglas and CES Production Function, MRTS, Iso-Costs, Optimal Combination of input factors, Economies and Diseconomies of Scale.

Unit-IV Cost Analysis

Concepts of Costs, Determinants of Cost functions, Cost- Output Relationship in the Short and Long run, Recent Developments in Cost Theory. Estimation of Cost Function- The Cubic Cost Function, Engineering and Survival Techniques, Breakeven Analysis.

Unit-V Market Structure and Pricing Practices

Types of Market Structure – Price-Output Determination in Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly in short and long run. Pricing Methods in Practice: Price discrimination, Product Line Pricing, Skimming Pricing, Penetrating Pricing , Loss Leader Pricing, Pricing of Multiple Products, Peak load Pricing, Pricing of Innovative Products.

Text Books:

1. Dominik Salvatore, "Managerial Economics", 8th edition, Oxford University Press, Noida, 2014
2. P.L.Mehta.,"Managerial Economics - Analysis, Problems and Cases", Sultan Chand and Sons, NewDelhi, 2014.
3. V.L. Mote, S.Paul and G.S.Gupta, "Managerial Economics Concepts and Cases",11th Edition,Tata McGraw Hill Pvt. Ltd., New Delhi, 49th Reprint 2010.
4. Geethika, Piyoli Ghosh, and P.R.Chaudhary "Managerial Economics", Tata McGraw Hill, New Delhi, 2015.

Suggested Readings:

1. R.L.Varshney and K.L.Maheswari, "Managerial Economics", 22nd Edition, Sultan Chand and Sons, New Delhi, 2014.
2. Barry Keating and J.Holten Wilson, "Managerial Economics", 2nd Edition, Bizmantra, New Delhi, 2009.
3. Michael R. Baye and Jeffrey T.Prince,"Managerial Economics and Business Strategy", 9th Edition, Tata McGraw Hill, 2017.
4. Dominick Salvatore, Siddhartha K.Rastogi, "Managerial Economics: Principles and world wide Applications", Oxford University Press, 8th Edition, 2016.
5. Truet, "Managerial Economics: Analysis, Problems and cases", Wiley Publishers, 2007.
6. Mark Hirschey, "Managerial Economics", Cengage Publishers, 12th Edition, 2013.

SCHOOL OF MANAGEMENT STUDIES
CBIT
Hyderabad

20MBC103

FINANCIAL ACCOUNTING FOR MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To understand the basic Accounting Concepts and practice Final Account applications in Business.
2. To acquaint the Students with the concepts of Depreciation, Valuation of Assets and critical evaluation of Financial Statements through Ratio Analysis and Cash Flow Statements.
3. To provide knowledge on basic Principles underlying the provisions of Direct and Indirect Tax laws and develop a broad understanding of the Tax laws and Accepted tax practices.

Course Outcomes: After Completion of the Course, Student will be able to:

1. Understand the basic concepts and principles of accounting and maintain the books of accounts.
2. Analyze and prepare the financial statements and understand the accounting standards.
3. Apply the different methods of depreciation and techniques of valuation of assets.
4. Analyze and interpret financial statements through ratio analysis and cash flow statements.
5. Handle Real life situations involving Taxation and equip themselves with techniques for taking Tax-Sensitive Decisions

Unit–I Introduction

Financial Accounting: Objectives, Accounting as a Business Information System; Parties interested in Accounting Information; Accounting Principles, Concepts and Conventions, Introduction to Book Keeping and Recording, Double Entry System, Books of Prime Entry, Subsidiary Books - Classification of Accounts-Accounting Cycle - Journal Proper, Ledger Posting, Preparation of Trial Balance, Suspense Account.

Unit- II Preparation of Final Accounts

Distinction between Capital and Revenue Expenditure - Preparation of Financial Statements -Trading, Profit and Loss account, Balance Sheet with Adjustments. Accounting Standards: Objectives, Scope, Applicability and Implementation of Accounting Standards -IAS- USGAAP International Financial Reporting Standards (IFRS).

Unit- III Valuation of Assets

Depreciation Accounting: Methods of providing Depreciation, Accounting Standards Depreciation Accounting (AS 6), Accounting for Fixed Asset-Application of AS 10.

Valuation: Basic Principles and Techniques of Valuation: DCF, Multiple Methods and Accounting Based Valuation. Asset Valuation: Earning Valuation, Cash flow Valuation. Valuation of Brands, Intangible Assets and Intellectual Property.

Unit –IV Financial Statement Analysis

Financial Statement Analysis: Ratio analysis, Rationale, Uses, Calculation and interpretation of Ratios-Liquidity Ratios- Profitability Ratios- Solvency Ratios-Leverage and Turnover ratios. Cash Flow Statement: Cash From Operations, Investment and Financing activities, Preparation of Cash Flow statement. Accounting Standards Cash Flow Statement (AS 3), Accounting Fraud and Governance.

Unit-V Corporate Taxation

Taxation: Types of Taxes: Direct Tax - Income Tax Act and Rules. Indirect Taxes- Central Excise and CENVAT - Customs Duty, Service Tax, Central Sales Tax and VAT - Primer on GST. Double Taxation Avoidance.

Text Books:

1. Jawaharlal and Seema Srivastava, "Financial Accounting Principles and Practices", 2nd Edition, S.Chand Publishing, 2014.
2. Aswath Damodaran, Investment Valuation: Tools and Techniques for Determining the Value of any Asset, 3rd (Wiley Finance) Edition, 2012.
3. Vinod K. Singhania, Monica Singhania, Taxmann's, Student Guide to Income Tax – including Service Tax/VAT.
4. Earl K Stice and James. D. Stice, "Financial Accounting – Reporting and Analysis", Cengage Learning, 2015.

Suggested Readings:

1. Ambrish Gupta, "Financial Accounting For Management – An Analytical Perspective", Pearson 6th Edition.
2. N. Ramachandran, Ram Kumar Kakani, "Financial Accounting For Management", 4th Edition, McGraw Hill, 2016.
3. Godiawala, Pathak et.al. "Business Taxation", 3rd Edition, Mc Graw Hill.
4. Dr. Jyothi Rattan, "Bharats Taxation Laws", 11th Edition, Bharats Law House, 2019.
5. Marco Vulpiani, "Special Cases of Business Valuation", 1st Edition Mc Graw Hill, 2014.
6. V.S. Datey (Taxmann's), Indirect Taxes Law and Practice, 42nd Edition, 2019.

20MBC104

MARKETING MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide knowledge on Marketing Concepts and Principles in Theory and Practice.
2. To focus on how a Marketer can effectively utilize Segmentation, Targeting and Positioning; and the Marketing Mix elements to attract and retain the Customer.
3. To create awareness on principal factors that influence Consumers as individuals and Decision makers with an application to the Buying Decision process and focus on Contemporary issues of Marketing.

Course Outcomes: After Completion of the Course, Students should be able to:

1. Know the various Philosophies of Marketing, and apply them in different Business Scenarios.
2. Understand various Segmentation, Targeting and Positioning strategies to make their Products as Market leaders.
3. Effectively design the Marketing Mix effectively in order to achieve the Organizational goals and objectives.
4. Analyze the challenges that might influence the formulation of effective Marketing Strategies from a Consumer Behaviour perspective.
5. To understand the Contemporary issues and develop Marketing Strategies to sustain in this Competitive World.

Unit –I Introduction

Marketing, Market, Core Marketing Concepts, Marketing Management, Marketing Management Philosophies, Marketing vs. Selling, Marketing Mix, Expanded Marketing Mix, Marketing Program and Marketing Strategy, Managing Marketing effort, Marketing Environment - Micro and Macro environment, Environment scanning, Interface with other Functional areas, Models of B2B, B2C,B2G, G2C.

Unit –II Customer-Driven Strategy

Market Segmentation – Segmenting Consumer Markets, Business Markets, International Markets, requirements for effective Segmentation. Market Targeting- Evaluating Market Segments, Selecting Target Market Segments, Socially Responsible Target Marketing. Differentiation and Positioning - Positioning Maps, Choosing Differentiation and Positioning Strategy, Communicating and delivering chosen Position.

Unit-III Marketing Mix

Products, Services, Brands, New Product Development, Product Life cycle, Pricing – Factors and Strategies, Costing vs Pricing, Discounts, CAPEX vs OPEX Models. Marketing Channels, Promotion – Advertising, Public Relations, Personal Selling, Sales Promotion, Direct and Online Marketing, Digital marketing.

Unit-IV Consumer Markets

Model of Consumer Behaviour, Seven Os Structure, Factors Affecting Consumer Behaviour, Stages in the Adoption Process, Industrial Markets- Characteristic, Industrial Buyer Behaviour, Services Markets – Characteristics and Strategies.

Unit-V Extending Marketing

Creating Competitive Advantage – Competitor Analysis, Competitive Strategies, Balancing Customer and Competitor Orientations. Global Marketplace. Corporate Social Responsibility (CSR) in Marketing, Sustainable Marketing – Social Criticisms of Marketing, Consumer Actions to promote Sustainable Marketing, Business Action toward Sustainable Marketing, Contemporary Issues in Marketing.

Text Books:

1. Kotler,P.,Armstrong, G.,Agnihotri, P.K., and Haque, E., Principles of Marketing: A South Asian Perspective, 13th Edition, Pearson Education Prentice Hall of India, 2010.
2. Lamb,C., Hair, J.,Sharma, D., and McDaniel, C.Marketing- A South- Asian Perspective, 1st Edition, Cengage Learning, 2016.
3. Ramaswamy V.S. Namakumari S, Marketing Management: Indian Context Global Perspective, 6th Edition, Sage Publications India Pvt Ltd., 2018.
4. Kurtz and Boone, Principles of Marketing, 15th Edition, Cengage Publications, 2013.

Suggested Readings:

1. Best, Roger, Market-Based Management, 6th Edition, PHI Learning Pvt. Ltd., 2013.
2. Saxena, R, Marketing Management, 6th Edition, McGraw-Hill Education, 2019.
3. Kotler, P., Armstrong, G., Agnihotri, P.K., Principles of Marketing, 17th Edition, Pearson Education, 2018.
4. Iacobucci, D., and Vohra, A., MM: A South Asian Perspective, 1st Edition, Cengage Learning, 2019.
5. Kotler, P., and Keller, K., Marketing Management, 15th Edition, Pearson Education, 2017.
6. Pradhan, D., Marketing Management: A Casebook, 1st Edition, Cengage ,2012.

20MB C105

STATISTICS FOR MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide an insight into Descriptive Statistics and Probability concepts.
2. To enable the Students to decide the appropriate Sampling techniques and facilitate formulation of Hypotheses and applying the Parametric Statistical tools to test the same and also interpret the results.
3. To enable the students to apply different Forecasting techniques for Business applications.

Course Outcomes: After Completion of the Course, the Students will be able to:

1. Understanding the concepts of statistics for business applications.
2. Analyze probability concepts with a view to ascertain the status of business position.
3. Apply the sampling theory in order to study the whole system.
4. Evaluate the statistic and parameter under various sampling conditions.
5. Apply the statistical concepts to forecast the trends in business outcomes.

Unit–I Descriptive Statistics

Statistics - An Overview, Its Applications - Descriptive Statistics: Measures of Central Tendency: Mean, Median, Mode, Measurement of Dispersion: Range and Quartile Deviation, Mean Deviation, Standard Deviation, Karl-Pearson's coefficient of Skewness and Kurtosis.

Unit-II Probability

i) Definitions and Rules of Probability. Additive and Multiplicative Law of Probability.
ii) Probability Distributions: Binomial Distribution, Poisson Distribution and Normal Distribution.

Unit-III Sampling and Estimation

Sampling theory: Sampling Procedures - Random and Non-Random Methods, Standard Error, Sampling Error. Statistical Estimations: Point and Interval Estimation, Properties of Good Estimator, Confidence Interval.

Unit-IV Inferential Statistics

i) Testing of Hypothesis: Type I and Type II Errors, Statistical Significance. Large Sample Tests- Test for One and Two Proportions, Test for One and Two Means, Test for Two Standard Deviations.
ii) Small sample tests: t- distribution- Properties and Applications, Testing for One and Two Means, Paired t- test.
iii) Analysis of Variance -One way and Two-way ANOVA (with and without interaction).
iv) Chi-square distribution: Test for goodness of fit, Test for independence of attributes.

Unit–V Correlation, Regression and Time Series

i) Correlation Analysis - Karl Pearson's Coefficient of Correlation-Spearman' Rank Correlation.
ii) Regression Analysis - Concept - Two lines of Regression - Properties of Regression Coefficients.
iii) Time Series Analysis - Trend Analysis - Free Hand Curve method - Method of Semi Averages - Method of Moving Averages - Least Squares Method.

Text Books:

1. Levin R.I., Rubin S. David, Siddiqui and Rastogi, "Statistics for Management", 8th Ed., Pearson, 2018.
2. S. C. Gupta, "Fundamental of Statistics", Himalaya, 2016.
3. J. K. Sharma, "Business Statistics", Pearson, 2015.
4. P N. Arora, Sumeet Arora, S. Arora , "Comprehensive Statistical Methods", S. Chand Co., 2015.

Suggested Readings:

1. Beri, G C, "Business Statistics", McGraw-Hill, 2015.
2. S. P. Gupta, "Statistical Methods", Sultan Chand and Sons, 2014.
3. Levine, Stephan, Szabat, "Statisics for Managers Using Microsoft Excel", 8th Ed., Pearson, 2018.
4. Anderson, Sweeney, Williams, "Statistics for Business and Economics",11th Ed., Cengage Learning, 2017.
5. Devore, "Probability and Statistics for Engineering and the Sciences", 9th Ed., Cengage Learning, 2016.
6. Ken Black, "Business Statistics for Decision Making", 6th Ed., Wiley, 2010.

20MBC106

DIGITAL TECHNOLOGY

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	3

Course objectives: The Objectives of the Course are:

1. To make the Students to improve the Skills in Digital Enterprise and learn the process of drafting various Business Correspondence.
2. To make the Students understand the development of Digital Enterprise Transformation.
3. To enable the Students to understand the importance of Digital Enterprise and it's functioning.

Course Outcomes: After Completion of the Course, Student will be able to:

1. Enhance competence in various Verticals of Business with Digital Transformation.
2. Compare and contrast the effective Business application in various Sectors with digital transformation.
3. Demonstrate the ability to effectively understand the Digital Enterprise from Company Leader's Perspective.
4. Familiarize with the Autonomous functioning of IT systems in various Business activities.
5. Familiarize with the concepts of Enterprise IOT.

UNIT-I Digital Enterprise Introduction

Building Digital Capabilities - Digital Mastery, Creating compelling Customer experience, exploiting the power of Core Operations, Reinventing Business Models. Domains of Digital Transformation: Customers, Competition, Data, Innovation and Value.

Case: How did Starbucks disrupt with their Mobile Order and Pay Service?

UNIT-II Digital Enterprise Transformation

Building Leadership Capabilities, Crafting your Digital Vision, Engaging the Organization at Scale, Governing the Transformation, Building Technology Leadership Capabilities. Business benefits of Reference Architectures, Design Patterns and Structures. Role of Context awareness in Interactive Digital experiences, Key Architectural considerations, Conceptual Model for Context - Aware Experiences.

Case: Context-aware Digital Employee Experience.

UNIT-III Leadership Perspective

A Leader's playbook for Digital Transformation: Framing the Digital challenge, Focusing Investment, Mobilizing the Organization, Sustaining the Digital Transformation. Build Platforms not just Products.

Case: How does Netflix Automation Platform help grow its Subscribers rapidly?

UNIT-IV Autonomous Systems

Autonomous IT Systems: Introduction, Reference Architecture, Maturity Model for Autonomous IT System, Design Patterns. Turn Data into Assets, Innovate by Rapid Experimentation.

Case: Autonomous Operation of a Customer, Partner, Employee Web Platform in an Enterprise.

UNIT-V Enterprise IoT

Enterprise IoT: Overview, Phenomenon of Internet connectivity, Phases of IoT evolution, Approach to Enterprise IoT, Reference Architecture for Enterprise IoT, Maturity Model for Enterprise IoT.

1. Case: Connected Mines
2. Case: Enterprise IoT Asset Management

Text Books:

1. Srikanth Narasimhan, Jagadish Chundury, "Enterprise Digitization Patterns Designing, Building and Deploying Enterprise Digital Solutions", Notion Press, 2018.
2. George Westerman,Didler Bonnet,Andrew McAfee "Leading Digital Turning Technology into Business Transformation", Harvard Business Review, 2014.
3. DavidL. Rogers, "The Digital Transformation Playbook Rethink your business for the Digital Age", Columbia Business School, 2016.
4. Amitabh P. Mishra, Ashish Ranjan, "A Modern Play book of Digital Transfromation", Sage Publishers, 2019 Edition.

Suggested Readings:

1. Lindsay Herbet, "Digtal Transformarion Build your Organization's Future for the Innovation Age", Bloomsbury Publishers, 2017.
2. Peter Weill, Stephanie L. Woerner, "What's your Digital Business Model?", Harvard Business Review, 2018.
3. George S.Day, Paul J. H.Schoemaker, "See Sooner, Act Faster: How Vigilant Leaders Thrive in an Era of Digital Turbulence (Management on the Cutting Edge)"The MIT Press,2019.
4. Thomas M. Siebel, "Digital Transformation: Survive and Thrive in an Era of Mass Extinction", Rosetta Books, 2019.
5. Tony Saldhanda, "Why Digital Transformations Fail: The Surprising Disciplines of How to Take Off and Stay Ahead", Brett Koehler Publishers, 2019.
6. Gerald C.Kane, Anh Nguyen Phillips, Jonathan R.Copulsky, "The Technology Fallacy: How People Are the Real Key to Digital Transformation (Management on the Cutting Edge)" MIT Sloan Management Review, 2019.

20MBC107

BUSINESS COMMUNICATION LAB

Instruction	4 Hour per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	2

Course objectives: The Objectives of the Course are:

1. To improve the skills in Listening Comprehensions and learn the process of drafting various Business Correspondence.
2. To develop the Professional way of Presentation in different Business Situations.
3. To enable the Students to understand the importance of Social and Professional Etiquettes.

Course Outcomes: After Completion of the Course, Student will be able to:

1. Display Competence in various Business Communication patterns.
2. Construct effective written messages in various Formats to Audience.
3. Demonstrate the Ability to effectively deliver Formal presentations before a variety of Audiences.
4. Communicate competently in Groups and Organizations and demonstrate Appropriate and Professional Ethical behaviour.
5. Build Strong Relationships and promote positive Atmosphere at Workplace.

Unit 1 Listening and Feedback

Listening Comprehensions - Situational Awareness and Active Listening related exercises.

Unit 2 Writing Skills

Managerial Writing - Writing Emails, WhatsApp and SMS to communicate internally and externally, Business Letters, Internal Communication through-Notices, Circulars, Memos, Agenda and Minutes. Report Writing.

Unit 3 Speaking and Presentation Skills

Types of Managerial Speeches - Speech of Introduction, Speech of Thanks, Occasional Speech, Theme Speech. Presentation for Business, Sales and Training with the aid of Verbal and Multimedia, Handling day to day meetings, Effective ways of Presenting, Participating, Leading and making Decisions – in less Critical to Critical Meetings.

Unit 4 Non Verbal Communication

Techniques to Improve Non Verbal Communication through Role plays and Management Games with focus on Gestures, Para linguistics, Proxemics, Kinesics and Artifacts.

Unit 5 Social and Professional Etiquette

Telephone Etiquette - E-mail Etiquette - Meeting Etiquettes, Cubicle Manners - Table Manners -Dress Code - Greetings.

Text Books:

1. Rani. D. Sudha, "A Manual for English Language Laboratories", Pearson Education, 2014.
2. Suresh Kumar, "A Handbook for English Language Laboratories", Foundation Books, 2009.
3. Sanjay Kumar and Pushp Lata, "Communication Skills", Oxford University Press, 2nd edition, 2015.
4. Lesikar R V et al., "Business Communication: Connecting in a Digital World", McGraw Hill Education, 2015.

Suggested Readings:

1. Kumkum Bhardwaj, "Fundamentals of Business Communication", Wiley (Dreamtech Press), 1st Edition, 2019.
2. Julian Dakin, "The Language Laboratory and Language learning", Addison-Wesley-Longman Ltd, UK, 1973.
3. Simon Morton, "The Presentation Lab: Learn the Formula behind Powerful Presentations", Wiley; 1st edition, 2014.
4. Steve Duck, David T. McMahan, "The Basics of Communication- A Relational Perspective", Sage Publishers, 2nd Edition, 2012.
5. Penrose, Rasberry and Myers, "Business Communication for Managers", Cengage Learning, 2007.
6. U S Rai and S M Rai, "Business Communication", Himalaya Publications, 2014.

20MBC108

STATISTICS LAB

Instruction	2 Hour per week
Duration of Semester Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Course Objectives: The Objectives of the Course are:

1. To Understand Descriptive statistics and its usage in Decision making in different disciplines.
2. To Explain the concept of Hypothesis and Parametric Tests.
3. To understand the relationship between two or more variables by using Appropriate Statistical Analysis Techniques.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Apply the methods of descriptive statistics and analyze the data by using MS Excel.
2. Foster the practical understanding of parametric test and to reveal the right inferences about the population.
3. Analyze one variable experiment by using one Way ANOVA.
4. Calculate Correlation coefficient and Simple Regression to interpret theOutcomes.
5. Examine Time Series model and extract meaningful insights about theData.

Unit-I Introduction to Descriptive Statistics

Measures of Central Tendency - Mean, Median, and Mode; Measures of Dispersion - Range, Quartile deviation, Standard Deviation and Variance, Coefficient of Variation, Population Confidence Intervals.

Unit-II Parametric Tests and Analysis of Variance

One Sample Z and T test for the Population Mean, Two samples Z and T test for the Population Mean. Chi Square Tests - Independence of Attributes. Single-Factor Experiments: One-way ANOVA.

Unit -III Correlation, Simple Regression and Time Series Analysis Correlation Analysis: Scatter Plot, Covariance and Pearson's Correlation coefficient, r. Simple Regression analysis, Time Series analysis: Fitting a Straight Line using simple data, Forecasting methods: Moving average.

Text Books:

1. Glyn Davis &BrankoPecar "Business Statistics Using Excel" Oxford University Press, 2nd edition, 2014.
2. D P Apte, "Statistical Tools for Managers using MS Excel", Excel, 2012.
3. David M Levine, David. F. Stephan & Kathryn A. Szabat, "Statistics for Managers Using MS Excel", PHI, 2015.
4. Bruce Bowerman, "Business Statistics in Practice", 5th edition, TMH, 2015.

Suggested Readings:

1. John Walkenbach, "Excel 2010 Bible", John Wiley & Sons, 2010 Edition.
2. Rao and Tyagi, "Research Methodology with SPSS", Shree Niwas Publications, 2009.
3. Albright C. S., Winston Wayne L. and Zappe C. J., "Decision Making Using Microsoft Excel", 2009, India Edition, CengageLearning.
4. Ajai.S.Gaur, SanjayaS.Gaur, "Statistical Methods for Practice and Research Response", 2009.
5. Wayne L. Winston, "Microsoft Excel 2016- Data Analysis and Business Modeling", PHI Learning, 2017.
6. ConardCarlberg, "Business Analysis with MS Excel", Que Publishing, 3rdedition.

CORE COURSES

20MBC201

HUMAN RESOURCE MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course objectives: The Objectives of this Course are to:

1. Provide the basic Concepts of Human Resource Management.
2. Enable the Students to understand the process of Recruitment and Selection and the Concept of Performance Management system in an Organization.
3. Understand the basics of Industrial Relations and knowledge of Labour laws and acquaint the Students with the Contemporary issues in Human Resource Management.

.**Course Outcomes:** After Completion of the Course, Students will be able to:

1. Understand and apply the knowledge of basic Concepts of Human Resource Management in Practical settings of an Organization.
2. Follow innovative practices in Recruitment and Selection.
3. Implement systematic Performance Management System in an Organisation.
4. Implement harmonious Industrial Relations and apply latest amended Labour Acts in an organization
5. Execute new trends in Human Resource Management practices.

Unit-I Introduction

HRM - Definition, Evolution, Organization of HR department, Objectives, Scope and Functions of HRM - Role and Responsibilities of HR Manager - HR Policies and Procedures - Competitive Challenges of HRM - Competency Framework for HR Professionals - Stakeholders and Integrated Models of HRM.

Unit-II Human Resource Planning

Job Analysis- Meaning and Importance, Process, Methods of collecting Job Data, Writing Job Description and Job Specification - Job Design - Meaning, Factors, Approaches - Job Evaluation - Meaning and Methods- HR Planning - Gallagher HR Estimator - Recruitment- Yield-Ratio Analysis - Process of Selection - Types of Interview - Placement and Orientation - HRD Training Methods - Kirkpatrick and Pecuniary Utility Models of Training.

Unit-III Performance Appraisal

Performance Appraisal – Meaning, Importance and Methods - Potential Appraisal- Capacity building - Basic components of Compensation Management - Towers Perrin Model of Total Reward - Career planning - Greenhouse Career Development Model - Psychological Contract- Functions and Types.

Unit-IV Industrial Relations

Industrial Relations - Definition, Importance, Basics of Industrial Acts - Employee State Insurance Act 1948, Employee Provident Fund and Miscellaneous Act 1952, Industrial Disputes Act 1947, The Payment of Gratuity Act 1972 - Dunlop's IR Model – Quality of Work Life - Grievance Management - Collective Bargaining - Negotiations and Assertiveness Skills – Worker's Participation in Management – Absence Management – Brad factor.

Unit-V Contemporary Issues in Human Resources Management

Introduction to Change Management - HR Outsourcing, Work Life Integration - Introduction to International HRM, Strategic HRM in a Changing Environment- HRIS: Three Levels - Diversity Management - Succession Planning - Inter -personal Relations in the Workplace - Expanding Professional and Personal Networks - HR Research.

Text Books:

1. Gary Dessler, "Human Resources Management", Pearson, 2015.
2. Decenzo, "Human Resources Management", Wiley, 11th Edition, 2015.
3. Michael Armstrong, "Human Resource Management", Kogan Page, 2015.
4. David Lepak, Mary Gower, "Human Resource Management", Pearson, 2015.

Suggested Readings:

1 John P. Kotter, "Leading Change", Harvard Business School Press, 2015.
2 Raymond Andrew Noe, John R. Hollenbeck, Barry Gerhart, Patrick M. Wright, "Fundamentals of Human Resource Management", 7th Edition, Mc Graw-Hill, 2017.
3 Arun Monappa, Ranjeet Nambudiri, Patturaja Selvaraj, "Industrial Relations and Labour Laws", McGraw-Hill, 2015.
4 V.S.P. Rao, "Human Resource Management", Cengage Learning, 2019.
5 K.Aswathappa, "Human Resource Management", 8th Edition, Mc Graw-Hill, 2017.
6 Raman Preet, "Future of Human Resource Management: Case Studies with Strategic Approach ", Wiley Publishers, 2019.

20MBC202

FINANCIAL MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To develop a broad understanding of the Concept of Finance functions and Time value of money, significance of Capital Budgeting techniques for the feasibility of Projects.
2. To gain knowledge about Theories of Capital Structure, Concept of Cost of Capital, and Dividend decisions.
3. To give insights about the importance of Working Capital Management and the tools to manage it.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the Concept of Finance function and judge the Time Value of money in terms Annuity and Present Values.
2. Assess the feasibility of Projects using Capital Budgeting Techniques.
3. Apply the Capital Structure Theories to construct the best Capital mix for better Market Value of the Firm.
4. Implement the Dividend decisions in the interest of the Stakeholders.
5. Assess Working Capital requirements and apply the Tools to manage it.

Unit-I Finance Function

Nature and Scope of Financial Management: Finance function, Goals of Finance- Profit Maximizing vs Wealth Maximization. Risk- Return trade off. Time Value of Money - Future value, Present Value: Single Cash flows, Annuity, Multi period Compounding (simple problems).

Unit-II Investment Decision

Capital Budgeting: Nature, Significance, Investment Decision process. Evaluation Techniques: Traditional - Payback method, Improvement in Traditional Payback, ARR and DCF Techniques - NPV, IRR, Profitability Index. Capital budgeting under Risk and Uncertainty: Risk adjusted Discount Rate, Certainty Equivalents, Probability Tree Approach. (Problems and cases), Projection Selection under Capital Rationing (theory).

Unit-III Financing Decision

Sources of Finance: Concept of Leverage - Operating Leverage, Financial Leverage, Combined Leverage. EBIT - EPS Analysis. Capital Structure Theories: Net Income approach, Net Operating Income approach, Traditional view and MM hypothesis.

Cost of Capital: Concept and Importance, Measurement of important Costs: Cost of Debt, Cost of Preference Capital, Cost of Equity Capital, Cost of External Equity, Cost of Retained Earnings, Weighted Average Cost of Capital. (Problems and Cases).

Unit-IV Dividend Decisions

Forms of Dividend, Dividend Theories: Relevance theory of Dividend: Walter's Model- Gordon's Model, Irrelevance Theory of Dividend: MM Hypothesis. Dividend policies of Indian Companies (Problems and Cases).

Unit-V Working Capital Management

Concept of Working Capital, Determinants of Working Capital, Estimation of Working Capital requirements, Working Capital Policy. Management of Current Assets: Cash Management, Receivables Management and Inventory Management (Problems and Cases).

Text Books:

1. I. M. Pandey, "Financial Management", 11th Ed. Vikas Publishing House, New Delhi 2015.
2. Khan, M. Y. and Jain P. K "Financial Management: Text, Problems and Cases", 6th Edition, Tata McGraw Hill Pub. Co. Ltd New Delhi, 2011.
3. Brigham, E. F. and Ehrhardt. M. C., "Financial Management Theory and Practice", 15th Ed., Cengage Learning, USA, 2015.
4. Jonathan Berk, Peter DeMarzo, Ashok Thampy, "Financial Management", 3rd Ed. Pearson Education Limited, UK, 2010.

Suggested Readings:

1. Vishwanath S.R., "Corporate Finance: Theory and Practice", 2nd Ed. Response books, Sage Publications Ltd, New Delhi, 2007.
2. Prasanna Chandra, "Financial Management Theory and Practice" 9th Edition, McGraw Hill, New Delhi, 2015.
3. S R Vishwanath, "Corporate Finance: Theory and Practice", Sage publishing India, 2nd Edition, 2007.
4. Clive Wilson, Bruce Keers, Ronwyn Johnston, Andrew Medlen, Brian Walters, "Financial Management", 6th Edition, Cengage, 2018.
5. BhallaV.K., "International Financial Management (Text and Cases)", S.Chand Publications, 1st Edition, 2014.
6. RuzbehBodhanwala, "Financial Management Using Excel Spreadsheet", Taxmann Publications Private Limited, 3rd Edition, 2009.

20MBC203

BUSINESS RESEARCH METHODS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of this Course are:

1. To provide understanding of the Concepts of Business Research Process, Ethics in Business Research and relevance of Research Designs used in Business Research.
2. To create an awareness on various Sources of Data, Sampling Methods and Methods of Qualitative and Quantitative Data Analysis and also to introduce Non-Parametric Tests.
3. To provide Students with an understanding of the basic Concepts of the Multivariate Techniques-its usefulness and provide guidance on how to prepare a Research Proposal and write a Quality Research Report.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand Business Research problems and will critically evaluate research papers considering Ethics in Research.
2. Compare and Contrast various Research Designs.
3. Analyze the similarities and differences between various Sampling Designs and Measurement Scales and make a Decision about how best to employ them in research studies.
4. Apply and interpret the Quantitative and Qualitative data and different types of Non-Parametric Statistical Tests.
5. Classify and select Multivariate Techniques so as to render appropriate solutions to the Business problems for attaining the Organizational Goals and effectively formulate a Research Proposal and communicate Research findings by preparing a Quality Research Report.

UNIT-I Introduction

Business Research - Meaning and Importance. Research Process - Overview. Review of Literature - Identifying, Accessing and Managing sources of Information and scholarly Literature. Research Gaps. Research Design - Introduction and Types - Exploratory, Descriptive and Causal Designs. Ethics in Business Research.

UNIT-II Data Collection and Sampling

Data Collection Methods - Primary and Secondary Sources. Design of Questionnaire. Sampling Procedure - Characteristics of a Good sample - Types of Sampling Designs and Sample size determination. Concept of Measurement and Scaling – Nominal, Ordinal, Interval and Ratio Scales, Rating scales -Thurston's, Likert's, Guttmann's, Semantic differential. The characteristics of Good Measures - Validity, Reliability and Practicality. Selecting a Measurement Scale

UNIT-III Data Processing and Analysis

Introduction to the analysis of Quantitative and Qualitative Data - Nature and Types of Data Analysis Methods. Non-parametric Statistics in Research - McNemar, Sign Test - One and Two samples, Run test, Wilcoxon Matched pairs test, Mann-Whitney test, Kolmogorov - Simronov D test, Kruskal –Wallis tests. Data Representation: Tabulation and Graphical presentation of Data.

UNIT-IV Multi-Variate Analysis

Structural and Functional Methods- Factor Analysis, Cluster Analysis, Discriminate Analysis, Conjoint Analysis, Multi-Dimensional Scaling. Structural Equation Modelling (SEM) - Overview. Multiple Regression (Numerical with two Independent Variables).

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UNIT-V Research Proposal and Report Writing

Research Proposal - Purpose, Nature and Evaluation - Content and Format. Report Writing and Presentation - Introduction - Types of Research Report. Format and Evaluation of the Research Report. Academic Writing and Referencing - Plagiarism.

Text Books:

1. Donald R Cooper and Pamela S Schindler, Business Research Methods, 12th Ed, TMH, 2018.
2. J.K.Sharma, "Business Statistics-Problems and Solutions", 1st Ed., Pearson, 2010.
3. Deepak Chawla and Neena Sondhi "Research Methodology - Concepts and Cases", Vikas Publications, 2018.
4. William G. Zikmund Et al., "Business Research Methods", Cengage Learning, 2016.

Suggested Readings:

1. Bajpai Naval, "Business Research Methods", Pearson , 2017
2. Alan Bryman and Emma Bell, "Business Research Methods", OUP Oxford, 2015.
3. ken and Black, " Applied Business Statitics", Wiley-India, 2012.
4. Saunders mark, Philip Lewis and Adrian Thornhill, "Research Methods for Business Students, Pearson, 2015.
5. Gabe T. Wang & Keumjae Park, "Student Research and Report Writing: From Topic Selection to the Complete Paper", Wiley-Blackwell, 2016
6. Umeshkumar Dubey , D P Kothari & G K Awari, "Quantitative Techniques in Business, Management and Finance: A Case-Study Approach", Chapman and Hall/CRC,2016.

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20MBC204

OPERATIONS RESEARCH

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of this Course are:

1. To familiarize the Students with the basic Concepts and tools of Operations Research.
2. To make the Students understand the mathematical models used in Operations Research.
3. To provide the Students to learn the techniques constructively to make effective Business decisions.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Develop mathematical model and solve the real life system with limited constraints by applying LPP.
2. Formulate and solve transportation and assignment concepts to implement Supply chain management.
3. Evaluate alternatives using decision making under risk and uncertainty and game theory.
4. Apply PERT and CPM techniques to plan, schedule and control project.
5. Apply simulation process in queuing theory to evaluate the system.

Unit-I Introduction

Operation Research, Definitions, Evolution, Scope and Applications in Business. Linear Programming: Models, Assumptions of LPP, Formulation, Graphical Method, Simplex Method, Big-M Method. Formulation of Dual to Primal.

Unit-II Transportation and Assignment

Transportation Problem, Initial Solution Methods, North -West Corner Method, Least Cost Method (LSM) and Vogel's Approximation Method, Degeneracy, Unbalanced TP. Optimality Test - Stepping Stone Method and MODI Method. Assignment Problem, Hungarian Method, Unbalanced problems, Restricted AP. The Travelling - Salesman problem.

Unit-III Statistical Decision Theory and Game Theory

Decision Theory, Criteria for Decision Making under Risk and Uncertain Environments, Concept of Utility, Expected Monetary Value, EVPI Utility as a Concept of Decision Making. Game theory, Zero Sum Game, Saddle point, Pure strategies, Mixed strategies, Dominance, Graphical Method for (mx2) and (2xn) games.

Unit-IV Project Management by Network Analysis

Network fundamentals - Scheduling the Activities - PERT Vs CPM - Three Time estimates - beta Distribution - Identifying Critical Path - Probability of completing the Project within Scheduled time, Critical Path Method - Optimization of Project parameters - Crashing.

Unit-V Queuing Theory and Simulation

Queuing Theory - Concepts of Queue/Waiting Line - General structure of a Queuing system - Operating characteristics of Queues, Probabilistic Queuing model - Single Channel Queuing model - Poisson arrival and Exponential service times with infinite Population. Simulation: Process of Simulation, Applications of Simulation to different Management Problems.

Text Books:

1. Richard .I. Levin, David. S. Rubin "Quantitative Approaches to Management", Mc Graw Hill International Book Co., 1992.
2. Barry Render, Ralph M. Stair, Jr., Michael E. Hanna "Quantitative Analysis for Management", Pearson Education, 2017.
3. J. K.Sharma, "Business Statistics - Problems and Solutions" Pearson, 2011.
4. S. D. Sharma, "Operations Research", Kedar Nath Ram Nath and Co., 2010

Suggested Readings:

1. H. A. Eiselt, Carl-Louis Sandblom, "Operations Research: A Model-Based Approach", Springer, 2010.
2. Edwin K. P. Chong, Stanislaw H. Zak, "An Introduction to Optimization", 4th Edition, A John Wiley & Sons Publications, 2013.
3. A. Ravi Ravindran, "Operations Research Applications", CRC Press, Taylor & Francis Group, 2009.
4. R. Panneerselvam, "Operations Research", 2nd Edition, PHI Learning, 2009.
5. Kanthi Swarup, Gupta Pk, Man Mohan, Sultan Chand and Sons, 2014.
6. Gupta Prem Kumar, Operations Research, S Chand, 7th ed., 2014.

20MBC205

OPERATIONS MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of this Course are:

1. To provide an understanding on the Process Planning, Design, Process Layout, Types of Production systems and to comprehend the different ways of measuring Productivity.
2. To develop Skills necessary to understand Work study and know the Techniques to Manage Inventory.
3. To provide knowledge on managing Quality and ways Total Quality Management facilitates Organizational effectiveness.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Apply knowledge of basic Concepts of Operations Management for developing processes and improving Operational Performance.
2. To develop aggregate capacity plans and Mater Production Schedule in operation environments and enabling the importance of facility location, layout and line balancing.
3. To identify and eliminate nonessential operations and develop feasible method of performing a job by applying work study techniques.
4. To calculate inventory levels and order quantities to make use of various inventory classification models.
5. To advance cognizance on Total Quality Management and to efficaciously implement the contemporary Quality techniques in an Organisation.

Unit–I Introduction

Introduction to Operations Management - The Historical evolution of Operations Management - Scope of Operations Management - Interface between the Operation Systems and Systems of other Functional areas. Process Planning and Process Design, Ergonomic Considerations, Production Planning and Control: Basic functions of Production Planning and Control, Production Cycle. Types of Production Systems - Project, Job Shop, Assembly, Batch and Continuous flow. Productivity- Measuring Productivity - Ways of improving Productivity. Recent Trends in Operations.

Unit-II Scheduling and Control of Production Operations

Aggregate Planning, Master Production Schedule (MPS), Operations Scheduling, Product Sequencing: Sequencing of Products in Multi- Product Multi - Stage

situations by using Johnson Rule and CDS method. Capacity Planning - Determinants of Plant Capacity, Capacity Planning Strategies and Line Balancing. Plant Location and Layout: Factors influencing Location, Different types of Layouts. Maintenance Management: Objectives, Preventive and Breakdown Maintenance, Failure Concept, Reliability, Replacement Policies. Information System for Maintenance Management.

Unit-III Work Study

Work Study - Method Study and Work Measurement - Objectives of Work Study - Relationship of Time and Motion Study to Work Study - Basic Work Study procedure - Various techniques in Method Study for identifying the most appropriate method. Work measurement - its uses and different methods, computation of allowance and Standard Time.

Unit-IV Materials and Inventory Management

Objectives of Materials Management - Materials Requirement Planning [MRP-I], Manufacturing Resource Planning [MRP-II] - Sources of Supply of Materials- Selection, Evaluation and Performance of Suppliers. Vendor Rating, Make or Buy decisions. Value Analysis: Aims, Procedure, Advantages and Application areas. Inventory Control - Need for Inventory, EOQ Model, and Economic Production Quantity Model.

Unit-V Quality Management

Quality - Need for Quality, Quality Gurus, Quality Awards, Bureau of Indian Standards, International Organization for Standardization. Quality Dimensions - Product and Service. Concept of TQM, Evolution of TQM - TQM Framework - Conventional vs. Total Quality Management. Quality Costs.

Text Books:

1. Stevenson J. William, "Operations Management", 13th edition, Tata McGraw-Hill, 2017.
2. Panneerselvam R, "Production and Operations Management", Prentice Hall India Learning Private Limited, 3rd edition, 2012.
3. Robert S. Russel, Bernard W III Taylor, "Operations Management", 7th edition, Hoboken, Wiley, 2011.
4. B Mahadevan, "Operations Management: Theory and Practice", Pearson Education India, 3rd edition, 2015.

Suggested Readings:

1. Jay Heizer, Barry Render, Chuck Munson, "Operations Management", 12th edition, Pearson, 2020.
2. Lee J., Krajewski,"Operations Management", 9th edition, PHI, 2009.
3. Everett. Adam, Jr. and Ronald J. Elbert, "Production and Operations Management Concepts", 5th edition, Prentice-Hall, 2006.
4. Richard Chase, Ravi Shanker, F. Robert Jacobs, "Operations and Supply Management", McGraw Hill Education, 12th edition, 2010.
5. K Aswathappa, K ShridharaBhat, "Production and Operations Management", Himalaya Publishing House Pvt. Ltd, 2nd edition 2015.
6. KanishkaBedi, "Production and Operations Management", OUP Australia and New Zealand, 2nd edition, 2007.

20MBC206

BUSINESS ANALYTICS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	3

Course Objectives: The Objectives of this Course are:

1. To provide in-depth knowledge of handling Data and Business Analytics tools that can be used for Decision-making in an Organization.
2. To familiarize Students on Data Warehousing Concepts, Data Mining Techniques and understand relationships between the underlying Business Processes of an Organization.
3. To provide knowledge on Prescriptive Analytics and its types, and the various applications of Business Analytics on different Domains.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the basic Concepts of Business Analytics in an Organization.
2. Establish the Data Warehousing Mechanism.
3. Experiment various methods of Visualization and Data mining methods.
4. Compare and contrast among Descriptive, Predictive and Prescriptive Analytics.
5. Practice the application of Business Analytics in different domains.

Unit-I Introduction

Introduction to Analytics, Data Science, Big Data. Applications of Analytics in different Domains. Business Analytics - Challenges from Outside and Within, BASP (Business Analytics Success Pillars) framework, Analyst's Role in the BA Model - Three Requirements the Analyst Must Meet.

Unit-II Descriptive Analytics

Data Warehousing - Introduction, Characteristics, Data Marts, Meta Data, Data Warehouse Architecture, Data Extraction, Transformation and Load Processes in a Data Warehouse Business Reporting and Business Performance Measurement and Visual Analytics.

Unit-III Predictive Analytics

Data Mining - Introduction, Characteristics, and Data Mining Process. Text Mining - Introduction, Text Analytics, Applications and Sentiment Analytics and Applications. Web Mining - Introduction, Web Analytics.

Unit-IV Prescriptive Analytics

Prescriptive Analytics - Introduction, Prescriptive Models - Simulation, Heuristic, Automated Decision Systems and Expert Systems, Knowledge Management.

Unit-V Future of Big Data

Big Data: Definition. Big Data Technologies - Hadoop, R, Python, Machine Learning and Artificial Intelligence. Data Scientist, Applications of Analytics in different Domains. Fundamentals of Marketing Analytics, Finance Analytics, HR - Analytics and Supply Chain Analytics.

Text Books:

1. U.Dinesh Kumar, "Business Analytics", Wiley, 2017.
2. Ramesh Sharada, Dursun Delen, Efraim Turban, "Business Intelligence and Analytics", 10th Ed., Pearson, 2014.
3. Jean Paul Isson, Jesse S.Harriot, "Win with Advanced Business Analytics" 1st Ed., Wiley, 2012.
4. Gert H.N. Laursen, Jesper Thorlund, "Business Analytics for Managers", John Wiley and Sons, Inc.2010.

Suggested Readings:

1. Laursen, Thorlund, "Business Analytics for Managers", 2nd Ed., Wiley, 2017.
2. Sahil Raj, "Business Analytics", 3rd Ed., Cengage Learning, 2015.
3. Albright, Winston, "Business Analytics - Data Analysis and Decision Making", 5th Ed., Cengage Learning, 2015.
4. Jac Fitz, Mattox II, "Predictive Analytics for Human Resources", 3rd Ed., Wiley, 2015.
5. Artun, Levin, "Predictive Marketing", 2nd Ed., Wiley, 2015.
6. R N Prasad, Seema Acharya, "Fundamentals of Business Analytics", Wiley, 2011.

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20MBC207

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	3

Course Objectives: The Objectives of the Course are:

1. To facilitate the Students to plan a Career in Business and to get a clear understanding of the Logistics and Supply Chain Management.
2. To provide insights in to the role of Logistics and Supply Chain Management in an Organization.
3. To make them focus on Warehousing and Transportation techniques, also to expound the role of other Functional areas for an effective Supply Chain.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the History, Evaluation and various Concepts of Logistics and Supply Chain Management.
2. Classify and compare Various Processes and Technology used in Logistics and Supply Chain Management.
3. Analyse and differentiate various strategies in Transportation and Warehousing in Logistics and Supply Chain Management.
4. Analyse Various Strategic issues and Manufacturing Techniques in relation to Logistics and supply chain management.
5. Develop best Network Design, Planning and Operations in Logistics and Supply Chain management.

Unit-I Introduction

Introduction to Supply Chain Management (SCM) - Concept, Evolution, Objectives, Importance and Functions of SCM, Conceptual Framework of SCM, Process view of Supply Chain , Supply Chain Strategies, Drivers and Metrics of Supply Chain. Strategic Fit, Achieving Strategic Fit and Obstacles.

Unit-II Logistics Management

Logistics Management, Inbound, Internal and Outbound Logistics in SCM, Logistics Organization, Development of Integrated Logistics Strategy, 3PL, 4PL, Reverse Logistics. Role and Importance of Inventory in SC, JIT, VMI, Outsourcing. SEZ in India, Dry Ports in India, Custom House Agent (CHA) ICDS.

Unit-III Transportation and Warehousing

Transportation in Supply Chain, Transportation Formats, Modes of Transportation, Transportation Performance factors, Modes of Transport, Fleet Management, Multi model transport, Containerization, Vehicle Scheduling and Routing, Milk run and Cross docking. Warehousing- Types of Warehouses, Warehousing Operations, Warehouse Management systems, RFID/CRM.

Unit-IV Strategic Issues in Supply Chain

Strategic Partnerships, Alliances and Collaborative advantage, Strategic relationships in-logistics, Bullwhip effect, Benchmarking - Issues and Problems, Types, Methods, Process, Lean Manufacturing, Agile Manufacturing. Laws related to Transport in India.

Unit-V Supply Chain Interface

SC Network Design, Distribution Network in Supply Chain, Factors influencing Design, Models in Distribution Network, Supply Chain Integration - Internal and External, Role of IT and HR in SCM, Retailing and SCM Green Supply Chain Management

Text Books:

1. Chandrasekaran. N, "Supply Chain Management Process, Systemand Practice", 2nd edition, Oxford University Press, 2012.
2. K. Shridhara Bhat, "Logistics and Supply Chain Management", 1st Ed. Himalaya Publishing House, 2016.
3. Sunil Chopra, Peter Meindl and D.V.Karla, "Supply ChainManagement, Strategy, Planning and Operations", 6th edition, Pearson education, 2016.
4. B. Rajashekar and G.V.R.K. Acharyulu, "Logistics and Supply chain Management", Excel Books, 2009.

Suggested Readings:

1. Shah, J, "Supply Chain Management, Text and Cases", 2nd Ed., Pearson Education, 2016.
2. Crandall, Richard E and others, "Principles of Supply Chain Management", 2nd Edition, CRC Press, 2014
3. Judy Dickens, "Supply Chain Planning and Execution", 1st edition, Willford Press, 2019.
4. Richard B Chase, Ravi Shankar and F Robort Jacobs, "Operations and Supply Chain Management", 15th edition, Mc Graw Hill Education, 2018.
5. James Stevens, "Supply Chain Management: Strategy, Operation & Planning for Logistics Management", 1st edition, Create Space Publications, 2016.
6. Sudalaimutu, S and Anthony Raj, "Logistics Management for International Business" 1st edition, PHI learning, 2009.

20MBC301

STRATEGIC MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To understand the role of Strategy and Environmental analysis in Business Decision Making
2. To provide insights on various Strategies, Practices, Competitiveness and Sustainability.
3. To help the Students develop their Skills for applying the Concepts in solving real time problems in Domestic and Global scenarios.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Investigate and understand the Business scenarios nationally and internationally.
2. Appraise and analyze the contemporary issues and challenges faced in Business
3. Craft and formulate the Strategies for real-time Business problems.
4. Integrate and apply the learned skills to implement Strategies from holistic and multi-functional perspectives.
5. Analyze and Evaluate real life situations for Self, Organizational and Societal sustainability.

Unit-I Introduction

Introduction to Strategic Management, Purpose of Business, Crafting and Executing Strategies, Strategic Intent, Developing Strategic Model, Choices of Strategy, Strategic Capability and Core competencies of Business, Phases of Strategic management, Strategic Decision Making.

Unit-II Strategic Analysis and Formulation

Environmental Scanning, SWOT & PESTEL Framework, Different Tools and Techniques for analyzing Strategies, Porters Five Force Framework, Organic Model of Strategic Planning, Real-time Strategy Planning, Strategic Formulation, Competitive Analysis, Strategy Development Processes.

Unit-III Strategies for Business

Types of Strategies- Offensive, Defensive, Exit and Entry barriers, Industry Life Cycle States and Strategies, Tailoring Strategy for Leaders, Challengers, Followers, weak and crisis Businesses, The Five Generic Competitive Strategies, Red and Blue Ocean Strategies, Grand Strategies.

Unit-IV Strategic Implementation

Impact and Issues of Culture, leadership, Resource Allocation, Staffing, Directing and Organizational Values on Strategic Implementation, Operationalizing and Institutionalizing strategy, Strategies for competing in International Markets, Managing Conflicts, Managing Strategic Change.

Unit-V Strategic Evaluation and Control

Strategic Evaluation, The Balanced Scorecard, Measuring Performance, Strategic control-Types, Strategic Information System, Issues in Managing Technology, Strategic issues in Entrepreneurial Ventures, small Businesses, Not-for-Profit Organizations, Sustainability and Sustainable Development.

Text Books:

1. Exploring Corporate Strategy, Gerry Johnson, Kevan Scholes, Richard Whittington, Prentice Hall, 8th edition.
2. Strategic Management and Business Policy-Towards Global Sustainability, Thomas L. Wheelen, J. David Hunger, Pearson Education, 13th edition
3. Strategic Management: A South Asian Perspective, Hitt & Ireland el al., Cengage Learning, 9th edition, 2013
4. Strategic Management: Concepts and Cases, Fred R. David, Prentice Hall, 13th Edition.

Suggested Readings:

1. Essentials of Strategic Management – The Quest for Competitive Advantage, John E. Gamble, Margaret A. Peteraf, Arthur A. Thompson, Jr., Mc. Graw Hill Education, 4th Edition.
2. Strategic Management: Creating Competitive Advantage, Gregory Dess and G. T. Lumpkin, TMH 2009.
3. Strategic management: Concepts and Cases, Thompson & Strickland, TMH, 2009.
4. The Blue Ocean Strategy Reader, w. Cham Kim, Renee Mauborgne, Harvard Business Review Press, 2017.
5. Strategic Planning: Formulation of Corporate Strategy, V.S. Ramaswamy, S. Namakumary, Macmillan Publishing House.
6. Strategic Management: Theory and Applications, Adrian & Alison, Oxford University Press, 2010.

20MBC401

ENTREPRENEURIAL DEVELOPMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course objectives: The Objectives of the Course are:

1. To sensitize the students about the concept and functions of entrepreneur with particular reference to Self-Employment and its process.
2. To educate on how to identify the Business Opportunities and to equip the Students with process of Project Formulation and Appraisal
3. To create awareness on how to raise funds from the appropriate institutional sources under suitable schemes and enable the Students to understand the role of Venture capitalists in Entrepreneurship Development.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the concept of entrepreneurship and its close relationship with Economic Development of a Country.
2. Identify the business opportunities and procedures to comply with.
3. Formulate, Execute and Evaluate Feasible project design.
4. Make use of the support rendered by Institutional Finance.
5. Identify the appropriate agencies for Venture Capital funding.

Unit-I Entrepreneurial Development Perspective

Concepts of Entrepreneurship Development, Evolution of the concept of Entrepreneur, Functions of an Entrepreneur, Theories of Entrepreneurship, Entrepreneur Vs. Intrapreneur, Entrepreneur Vs. Entrepreneurship, Entrepreneur Vs. Manager, Attributes and Characteristics of a successful Entrepreneur, Role of Entrepreneur in Indian economy and developing economies with reference to Self-Employment Development, Entrepreneurial Culture.

Unit-II Creating Entrepreneurial Venture

Business Planning Process, Environmental Analysis - Search and Scanning- Identification of Problems and Opportunities- Various Sources of Business opportunities. Entrepreneurship Development Programmes (EDPs) - Meaning and Types. Basic Government Procedures to be complied with. Role of Central Government and State Government in promoting Entrepreneurship.

Unit-III Project Management

Project: Concept and Classification- Project Identification, Project Formulation, Common errors in Project Formulation- Project Report, Project Appraisal- Technical, Financial, Marketing, Personnel and Management Feasibility.

Unit-IV Institutional Finance

Estimating and Financing the Funds requirements- Institutional Finance to Entrepreneurs- Need and Importance, Institutional finance from IDBI, IFCI, LIC, UTI, NABARD, SFCs, SIDCs EXIM Bank. Role of NSIC, SSIB, SSICs for Entrepreneurship development. Schemes offered by various Commercial Banks.

Unit-V Start-up and Venture Capital

Start-up Basics - Opportunity, Ideation, Customer Discovery, Market Analysis. Business Incubation centres. Venture Capital Financing Concept and features. Structure and regulatory framework of venture capital financing in India. Investment process and evaluation- Structuring venture capital financing. Exit Strategies of Venture capitalist.

Text Books:

1. E.Gordon & K. Natarajan, "Entrepreneurship Development", HPH, 2017
2. Vasanth Desai, "Dynamics of Entrepreneurial Development and Management", S. Chand & Co. Ltd, 2013.
3. S.S. Khanka, "Entrepreneurship Development", S. Chand & Co. Ltd, 2007
4. Coulter, "Entrepreneurship in Action", PHI, 2005

Suggested Readings:

1. Ogbe Alloysius Augustine, "Fundamentals of Entrepreneurship Development", Panamaline Books Distributors Limited, August, 2018.
2. Brito Silvio Manuel, "Entrepreneurship: Trends and Challenges", InTech, April, 2018.
3. David H. Hott, " Entrepreneurship New Venture Creation, PHI, 2016
4. Charantimath Poornima M , "Entrepreneurship Development and Small Business Enterprises", Pearson Education, 2018
5. Amit Kumar Dwivedi, "Cases In Entrepreneurship " Bookwell Publications, 2014
6. B. Janakiram & M. Rizwana "Entrepreneurship Development: Text & Cases", Excel Books, 2011.

20MBE301

INVESTMENT MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The objectives of the course are:

1. To provide in-depth analysis of various investment opportunities including fixed income securities.
2. To demonstrate fundamental and technical analysis along with common stock valuation.
3. To provide an insight into portfolio theories and evaluation.

Course Outcomes: After completion of the course, students will be able to:

1. Classify various investment options with risk and return calculations.
2. Evaluate the bonds and strategies to manage them.
3. Choose the investment option with the help of fundamental and technical analysis.
4. Measure the value of common stocks by applying various approaches.
5. Construct the portfolio using various models.

Unit-I Introduction

Concept, Investment Decision Process; Real vs. Financial assets; Sources of investment- information; Investment vs. Speculation; Factors to be considered in investment decision. The concept and Measurement of Risk and Return (Individual and Portfolio) - Range, Standard Deviation and Co-Efficient of Variation, Ex-ante and ex-post returns. Risk return trade-off. (Simple Problems).

Unit-II Fixed Income Securities

Fixed Income Securities Features and types of debt instruments, Types of bonds- Euro bonds, Foreign bonds and Global bonds, Gold Bonds, Bond indenture, factors affecting bond yield. Bond yield measurement - Current yield, holding period return, YTM, AYTM and YTC. Bond duration- Macaulay's duration and modified Macaulay's duration. Bond convexity. Bond portfolio management strategies - active and passive. (Problems and Cases).

Unit-III Fundamental and Technical Analysis

Approaches to Investment analysis- Fundamental Analysis- Economy, Industry and Company analysis - Factors, Technical Analysis. - Dow theory, charts, moving averages, Relative strength index, Efficient Market Hypothesis, Japanese candle stick method. (Problems and Cases).

Unit- IV Common Stocks- Analysis and Valuation

Common Stocks - Analysis and Valuation Basic Features of Common Stock, Approaches to valuation- Balance sheet model, dividend capitalization models; earnings capitalization models; Security Market Indexes, their uses; computational procedure of Sensex and Nifty. (Problems and Cases).

Unit- V Portfolio Theory and Evaluation

Portfolio Theory and Evaluation Concept of portfolio. Portfolio return and risk. Harry Markowitz's Portfolio theory, construction of optimal portfolio, Single-index model. Capital market theory: Introduction of risk-free asset, Capital Market Line (CML). Capital asset pricing model (CAPM): Security Market Line (SML). Arbitrage Pricing Theory (APT): The Law of one price, two factor arbitrage pricing. Introduction to Mutual Funds. Performance measures - Sharpe's reward to variability index, Treynor's reward to volatility index, Jensen's differential index, Fama's decomposition of returns. (Problems and Cases).

Text Books:

1. Charles P.Jones, "Investments Principles and Concepts", 12th edition, Wiley India edition. 2016.
2. Prasanna Chandra, "Investment Analysis and Portfolio Management", 5th edition, McGraw Hill India, 2017.
3. V.K.Bhalla , "Investment Management", 17th edition, S.Chand Publications, 2016.
4. Donald E. Fischer, Ronald .J.Jordan & A K Pradhan , "Security Analysis and Portfolio Management", 7th edition, Pearson Education, 2018

Suggested Readings:

1. Punithavathy Panidan, "Securities Analysis and Portfolio Management", 2nd Edition, Vikas Publications, 2012.
2. V A Avadani, "Securities Analysis and Portfolio Management", 12th revised edition, Himalaya Publishing House, 2019.
3. Reilly & Brown, "Investment Analysis and Portfolio Management", 10th edition, Cengage, 2016.
4. Kevin S, "Securities Analysis and Portfolio Management", 2nd revised edition, PHI learning, 2015.
5. Mab Faber, "Global Value- How to spot Bubbles, Avoid Market Crashes, and Earn Big Returns in the Stock Market", 1st edition, Mebane Faber publishers, 2014.
6. Alexander. G.J, Sharpe.W.F and Bailey, J.V, "Fundamentals of Investments", 3rd edition, PHI, 2001.

20MBE302

FINANCIAL MARKETS AND SERVICES

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:
1. To make the Students understand the structure and functions of the Financial Markets, Financial Instruments and Financial Market Intermediaries.
2. To equip the Students with various patterns of Trading and Settlement and Financial Services.
3. To provide insights into Insurance Services and Claims Management.

Course Outcomes: After Completion of the Course, Students will be able to:
1. Have a comprehensive overview on Financial Markets and Instruments.
2. Understand the Trading and Settlement activities.
3. Acquire Knowledge on various Financial Services and the Regulatory Framework.
4. Enhance knowledge on various types of Insurance Services.
5. Gain insights on Claims Management Procedures.

Unit-I Introduction
Structure of Indian Financial System, Role of Financial System in Economic Development, Financial Markets: Money Market, Capital Markets, Commodities Market and FOREX Market- an Overview. Stock Exchanges: Functions, Listing and Formalities. Role of SEBI in India. Financial Instruments: Commercial Paper, Certificate of Deposit, Treasury Bills, Commercial Bills, Gilt-edged Securities, Equity Shares, Preference Shares, Debentures, Warrants and Convertibles, ADRs and GDRs, Mutual Funds.

Unit-II Trading and Settlement
Demat account, Patterns of Trading and Settlement, Speculations- Types of Speculations, Activities of Brokers, Broker Charges, Settlement Procedure. Financial Intermediaries: Merchant Bankers, Underwriters, Bankers to an Issue, Registrars and Share Transfer Agents, Debenture Trustees, Portfolio Managers. Role of NSDL and CDSL. Credit Rating Agency: Functions, the ABCs of rating scales, Global Credit Rating Agencies.

Unit-III Financial Services
Concept, Nature, Scope and Functions of Financial Services. Types of Financial Services: Hire Purchase, Consumer Credit, Factoring and Forfeiting, Housing Finance, Venture Capital and Lease Financing. Growth of financial services in India. Regulatory Framework of Financial Services. Contemporary issues in Financial Markets and Services.

Unit-IV Insurance Services
Introduction to Insurance: Terminology, Procedure, Various methods of calculating Premium, factors affecting Premium calculations. Principles of Insurance, Concept of Corporate Insurance: Fire, Marine, Machine and Electronic Equipment, Motor Vehicle, Money in transit and Burglary, Fidelity, Directors and Officers Insurance Policy. Basic concepts of Life and General insurance. Types of Insurers, Functions of Insurers: Production, Underwriting, Rate Making. Reinsurance.

Unit-V Claims Management
Managing Claims and Losses: Understanding procedures and calculating Receivables amount, Causes for short settlement and procedures to reduce, Grievance redressal and legal aspects. Organizing and controls for Risk Management, Purchase of Insurance Policies and Services, Cost Optimization, Insurance as a tool for Risk Management. Banc-Assurance. Role of Insurance Regulatory Development Authority.

Text Books:

1. Sandeep Goel, "Financial Markets, Institutions and Services", PHI Learning, 2018.
2. Emmett J. Vaughan; Therese M. Vaughan, "Fundamentals of Risk & Insurance", Wiley,India Edition, 11th Edition 2013.
3. Pathak Bharati V., "The Indian Financial System- Markets, Institutions and Services", 3rd Edition, Pearson Education.
4. Mishra M.N., "Life Insurance, Administration and Management", Sultan Chand & Co., New Delhi, 22nd Edition, 2016.

Suggested Readings:

1. Kumar Vinod, Gupta Atul, Kaur Manmeet, "Financial Markets Institutions & Financial Services", Taxmann's, 2017 Edition, July, 2017.
2. Blokdyk Gerardus, "Claims Management A Complete Guide", The Art of Science, 2019 Edition.
3. Rejda George E., "Principles of Risk Management and Insurance", Pearson Education, Tenth Edition, 2011.
4. Dobbyn John, French Christopher, "Insurance Law in a Nutshell", West Academic Publishing, 5th Edition, 2016.
5. Bhole, L.M., "Financial Institutions and Markets: Structure, Growth and Innovations", McGraw-Hill, New Delhi, Fourth Edition, 2008.
6. M Y Khan, "Financial Services", McGraw Hill Education (India), 8th Edition, 2015.

20MBE304

TRAINING AND DEVELOPMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To develop an understanding of the Concept and Importance of Training and Development.
2. To discuss the practice of Training and Development in the modern Organizational setting.
3. To familiarize Students with the tools and techniques involved in the implementation and evaluation of Training, besides giving an overview of emerging training trends.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Get familiarized with how to do Training and Development Programmes and recall its importance.
2. Efficiently conduct Needs Assessment and design the Training Programme as per the demands of the Industry requirements
3. Make use of an appropriate Training and Developments method so as to contribute to the Organizational Success.
4. Identify the suitable mechanism for the implementation of the Training and Development Programmes.
5. Choose right mechanism to evaluate the Training and Development methods initiated and understand the emerging Training and Development trends in the Organizations.

Unit- I Introduction

Training and Development- Concepts, The role of Training in the Organizations, Essentials of Management Development Programmes, Field areas of Employee Training, Importance and Benefits of Training and Development, Structure of Training Organizations, A Training Process Model, Training Practices in Modern Organizations.

Unit- II Needs Assessment and Designing the Programme

Understanding the Why, When and Where aspects of Training Need Analysis (TNA), The Framework for Conducting a TNA- Organizational, Operational and Person Analysis, Outcomes of TNA- Training and Non Training Needs, Approaches to TNA- Proactive and Reactive Approaches.

Organizational constraints, developing Objectives - Identifying and writing a Good Learning Objectives. Facilitation of Learning and Training Transfer, Design theory- Elaboration and Gagne- Briggs Theories, Outcomes of the Design.

Unit-III Methods of Training and development

Overview of On-the Job and off-the Jobs methods, Matching methods with Outcomes, Important Training Methods- Lectures and Demonstration, Computer-Based Training, Games and Simulations, Sensitivity Training method, Teaching Aids for Training- selecting appropriate Training Aid, Principles of using Audio-visual Aids- Static and Dynamic media, Management Development Implications, Training for Executive-Level Management.

Unit-IV Implementation and Evaluation

Integrated Instructional Strategy- Content, Method of instruction, Facilities- Training room and the off-site Training facilities, Material and Equipment and Trainers, The Strategy. Implementation- Dry Run, Pilot Program, Tips for Trainers for Effective Implementation.

Rational for evaluation, Resistance to Training Evaluation, Types of Evaluation, Evaluation Design Issues.

Unit-V Emerging Training and Development Trends

Future Global Trends and Perspectives in Training and Development, Trend setting elements for Training and Development- Globalization, Priority differences of Countries and Companies, In-house v/s Training Outsourcing, Consultation Movement, Advancements in Appraisal Technique, E-learning, Cyber Training Programmes, Harnessing the Advancement in Training Technology.

Text Books:

1. P.Nick Blanchard, James W. Thacker, A.Anand Ram, Effective Training, Systems, Strategies and Practices, Pearson, 2013.
2. Raymond A Noe, Amitabh Deo Kodwani, Employee Training and Development" McGraw Hill, 2018
3. Rolf Lynton, Uday Pareek, Training for Development, Sage India, 2011.
4. Dipak Kumar Bhattacharyya, Training and Development: Theories and Applications, Sage Publications, 2015.

Suggested Readings:

1. Rishipal, "Training and Development Methods", S. Chand & Company Ltd, 2011
2. Jean Barbazette,"Managing the Training Function For Bottom Line Results: Tools, Models and Best Practices", Pfeiffer, 2008.
3. Pandu G. Naik,Training and Development: Text, Research and Cases, Excel Books 2008.
4. B. Janakiram, Training and Development: Indian Text edition, Dream tech Press; Indian Text edition, 2007.
5. R.K. Sahu, Training and Development, Excel Books India, 2009.
6. Steve W. J. Koziowski, Learning & Development in Organizations, Rouledge, 2010.

20MBE305

PRODUCT AND BRAND MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide an understanding of New Products, explore New Product ideas, new Product Development and the Strategies for Product Portfolio planning of a conglomerate.
2. To familiarize the Students understand the Brand Image, Brand Identity, Brand Equity, Branding Decisions and Brand Audit.
3. To develop the understanding of Brands with Consumer Behaviour, Brand Architecture and its Strategies.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Easily comprehend New Product Development Process and its Models, and learn to create actionable focus to successfully manage the Product.
2. Design the Product Portfolio Strategies for a conglomerate, manage and amplify existing products.
3. Analyze the Branding Strategies, Brand Purpose- Managing Brand Reputations.
4. Understand and conduct the measurement of Brand Equity and Brand Performance, design Brand Architecture Strategies in real life situation.
5. Learn the Contemporary Issues and analyze Future Trends.

Unit-I Introduction

Product, Policy, objectives, Product Mix concepts - Product Line, Product Length, Product Depth, Product Breadth, Product Mix decisions, Packaging, Product Modification and Deletion. New Product Development: Innovation and Diffusion of product. New Product Development (NPD) - Process, Models.

Unit-II New Product Development Process

New Product Introduction, Growth Strategies Intensive, Interactive, Diversification strategies. Product Portfolio analysis BCG, GE, Ad little. Shell International. Idea generating device. Role of R & D. Product Maps, Market Maps and Joint Space Maps-Perceptual and Preference mapping. Idea- Screening. Product Concept generation, concept selection, and Concept Testing, Design for manufacturing, Product Prototype and Product Recalls.

Unit-III Brand Management- Knowledge, Identity and Positioning

Brand vs commodity, understanding Brands, benefits of Branding, Brand Attributes, Branding Decisions, Brand Awareness and Consumer Brand knowledge, Brand Image, Brand Identity, Brand associations, Establishing P.O.P and P.O.D, Brand Personality, Brand Extension, Line extensions Brand Licensing, Franchising and Global Branding, Brand Positioning- Strategies and Repositioning Straddle Positioning and Brand Mantra.

Unit-IV Crafting, Measuring and Managing Brand Equity

Creating Brand Equity, models of Brand equity – Brand Asset Valuator, Aaker model, Brandz and Brand Resonance, measuring Brand Equity, Building Brand Equity, Tracking Valuation Managing Brand Equity-Brand worth, Reinforcement, Revitalization and Brand Crisis.

Unit-V Brand Architecture Strategies

Introduction to Brand Architecture Strategies and its designing, Brand - Product Matrix, Breadth and depth of Branding Strategy, Brand Architecture systems, Brand Hierarchy, Branding policies.

Text Books:

1. Moore William L., Pessemier Edgar, Product Planning and Management: Designing and Delivering value, McGraw-Hill, Inc., 1993.
2. Ulrich K T, Eppinger D Steven, Goyal Anitha, Product Design and Development, 6th edition, Tata McGraw Hill, 2010.
3. Tapan K. Panda, Product and Brand Management, 1st edition, 2016, Oxford University Press.
4. Aaker D, Building Strong Brands, The Free Press, Simon and Schuster, New York, 2012.

Suggested Readings:

1. Dr. Anandan, Product Management, 2nd edition, Tata McGraw Hill, 2010.
2. Majumdar, R, Product Management in India, 3rd Edition, PHI Learning Pvt. Ltd, 2009.
3. Kapferer, J N, The New Strategic Brand Management: Creating and Sustaining Brand Equity Long Term, 4th edition, Kogan Page, 2008.
4. Kavin Keller, 4th edition, Strategic Brand Management. Pearson Education, 2008.
5. U C Mathur, Product and Brand Management, 2nd edition Excel Books, New Delhi, , 2009.
6. Tapan K Panda, 1st edition, Building Brands in the Indian Market. Excel Books, New Delhi, 2008.

SCHOOL OF MANAGEMENT STUDIES CBIT Hyderabad

20MBE306

INTEGRATED MARKETING COMMUNICATION AND DIGITAL MARKETING

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To make the Students understand the basic Concepts of Integrated Marketing Communication, Planning and Evaluating Marketing Communications Strategies and Executions.
2. To provide a comprehensive understanding of Brand Promotion, Audience engagement, Public Relations and Strategic Communications.
3. Understand the importance of Digital and Social Media Marketing and its applications.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the process of creating valuable Brand and how to engage Consumers via Integrated Marketing Communications.
2. Analyze the important issues when planning and evaluating Marketing Communications Strategies and Executions.
3. Develop an effective Integrated Marketing Communication Process.
4. Evaluate the knowledge in Marketing Communication which ensures that they make the correct decision in Communications, Advertising and Digital Marketing in real scenario.
5. Examine the applications of Digital and Social Media Marketing in the Globalized market.

Unit-I Introduction

Integrated Marketing Communications, Recent Trends in the Market, Understanding the Marketing Process, Decisions for Effective Communications Campaign, Building Customer Based Brand Equity, Brand Loyalty, Successful Marketing Communications Campaign, Choosing Marketing Communications Agency, Structure of an Advertising Agency.

Unit-II IMC Planning Process

Consumer Information Processing, Steps of Effective Communications, Communications Objectives, How Advertising works – AIDA and Hierarchy of Effects Models, Consumer Approach to Buying Process: FCB Grid, Determining Marketing Communications Budget, Relationship between Communications Budget and Sales.

Unit-III Marketing Communications Mix

Theoretical Approaches to Advertising Design, Message Strategies - Cognitive, Affective and Conative, Advertising Appeals- Emotional, Fear, Humor, Rationality, Sex, Scarcity, Executional Frameworks- Animation, Slice of Life, Dramatization, Informative, Testimonial, Authoritative, Demonstration, Fantasy. Sales Promotions, Public Relations, Direct Marketing, Event Management, Sponsorship and Cause Related Marketing, Alternative Marketing, Crisis Management, Trade Fair and Exhibitions.

Unit-IV Digital Marketing

Digital Marketing - Components, Benefits, Plan, Skills required for Digital Marketing, Digital Marketing Platforms and Strategies, Trends, Search Engine Optimization and Content Marketing.

Unit-V Social Media

Social Media Marketing – Social Networking with Facebook, LinkedIn, Blogging as a social medium, Microblogging with Twitter, Social Sharing with YouTube, Social media for Customer Reach, Acquisition and Retention. Evaluation of an Integrated Marketing Communications Campaign.

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Text Books:

1. Terence A. Shimp, J. Craig Andrews, Advertising, Promotion, and other aspects of Integrated Marketing Communications, 9th edition, Cengage, 2016
2. Kruti Shah and Alan D'Souza, Advertising and Promotions – An IMC Perspective, Tata Mcgraw Hill, 2013.
3. Michael Miller, B2B Digital Marketing, 1st edition, Pearson, 2014.
4. Seema Gupta, Digital Marketing, 1st edition, Mc Graw Hill, 2018.

Suggested Readings:

1. Belch George E; Belch Michael; Purani Keyoor, Advertising and Promotion- An Integrated Marketing Communications Perspective, 9th edition, Mc Graw Hill, 2013.
2. Jerome M.Juska, Integrated Marketing Communications- Advertising and Promotion in a Digital World, Routledge, 2017.
3. Dutta, Kirti, Integrated Marketing Communication, 1st edition, Oxford University Press, 2016.
4. Dave Evans and Jake Mckee, Social Media Marketing. Wiley India Pvt. Ltd., 2011.
5. Dodson, I, The art of digital marketing: the definitive guide to creating strategic, targeted, and measurable online campaigns, 1st edition, John Wiley & Sons, 2016.
6. Moutusy Maity, Internet Marketing: A Practical Approach in the Indian Context, 1st edition, Oxford University Press, 2017.

20MBE307

BUSINESS DATA MINING

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To familiarize the students to understand the concepts of Data Mining and Preprocessing of Data.
2. To provide insights on Association Rule Mining and Clustering.
3. To demonstrate the application of Logistic Regression and Sentiment Analytics to solve Business Problems.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the concepts of Data Mining and Data Preprocessing.
2. Extract and represent the knowledge from data by Preprocessing and Visualization
3. Establish the Association among frequently purchased items and categorize the dataset into different clusters.
4. Understand the concept of classification problems and their applications across different sectors.
5. Apply sentiment analytics to various real time business applications.

Unit-I Introduction

Data Mining; Kinds of data that can be mined- Database Data, Data Warehouses, Transactional Data, Other Kinds of Data; Major Issues in Data Mining- Mining Methodology, User Interaction, Efficiency and Scalability, Diversity of Database Types, Data Mining and Society

Unit-II Data Preprocessing

Data Preprocessing: An Overview- Reasons to process the data, Major Tasks in Data Preprocessing; Data Cleaning- Missing Values, Noisy Data, Data Cleaning as a Process; Data Reduction- Principal Component Analysis, Histograms, Clustering, Sampling, Data Cube Aggregation; Data Transformation and Data Discretization- Data Transformation by Normalization, Discretization by Binning, Discretization by Histogram Analysis.

Case Study: Handling Missing Values in Melbourne Housing Price Data.

Unit-III Association Rule Mining and Clustering

Mining Association Rules- Item sets, Association Rules, Generating Rules Efficiently; Metrics for Association Rule Mining- Support, Confidence and Lift; Pros and Cons of Association Rule Mining.

Clustering- Finding Similarities Using Distances- Euclidean Distance and Other Distance Metrics; K- Means Clustering and Hierarchical Clustering; Comparing Clusters Created by K-Means and Hierarchical Clustering

Case Study III.1: Market Basket Analysis of Groceries Dataset

Case Study III.2: Mall Customer Clustering

Unit-IV Classification Problems- I- Logistic Regression

Overview of Classification; Binary Logistic Regression; Classification- Encoding Categorical Features, Building Logistic Regression Model, Printing Model Summary, Predicting on Test Data; Measuring Accuracies- Creating Confusion Matrix, Receiver Operating Characteristic (ROC) and Area Under the Curve; Finding Optimal Classification Cut-off -Youden's Index and Cost- Based Approach.

Case Study: Predicting Employee Attrition on HR Attrition Dataset.

Unit-V Sentiment Analytics Using Naïve Bayes Algorithm

Exploring the Dataset; Text Preprocessing- Bag-of-Words Model, Creating Count Vectors, Displaying Document Vectors, Removing Low Frequency Words, Removing Stop Words, Creating Count Vectors, Distribution of Words across Different Sentiment.

Using Naïve Bayes Model for Sentiment Classification

Using n-Grams for Sentiment Classification

Case Study: Sentiment Analytics on Sentiments Expressed by Users of Zomato

Text Books:

1. Szabo, Gungar Polatkan, Oscar Boykin, Chalkiopoulos, "Social Media Data Mining and Analytics", 3rd Ed., Wiley, 2019.
2. Ian H. Witten, Eibe Frank, Mark A. Hall, Christopher J. Pal, "Data Mining: Practical Machine Learning Tools and Techniques", 4th Ed., Elsevier, 2017.
3. Megan Squire, "Mastering Data Mining with Python – Find patterns hidden in your data", 1st Ed., PACKT Publishing, 2016.
4. Florin Gorunescu, "Data Mining: Concepts, Models and Techniques", Vol 12, Springer, 2011.

Suggested Readings:

1. Luis Torgo, "Data Mining with R: Learning with Case Studies", 2nd Ed., CRC Press, 2011.
2. Jiawei Han, Jian Pei, Micheline Kamber, "Data Mining: Concepts and Techniques", 3rd Ed., Elsevier, 2010.
3. Joseph B. Pigus, "Data Mining With Neural Networks", 2nd Ed., TMH, 2017.
4. Robert Layton, "Learning Data Mining With Python", 2nd Ed., PACKT Publishing, 2015.
5. Xin-She Yang, "Introduction to Algorithms for Data Mining and ML", 1st Ed., Academic Press, 2019.
6. Boris Kovalerchuk, Evgeni Vityaev, "Data Mining in Finance", 3rd Ed., Kluwer Academic Publishers, 2010.

20MBE308

Python Programming

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To Understand Python programming and related eco-system of libraries and packages.
2. To demonstrate usage of Python as standard Programming Language.
3. To analyze the data and represent the data with various visualization techniques.

Course Outcomes: On successful completion of this Course, Students will be able to:

1. Understand the basics of Python and extend the functionality using add-on packages.
2. Identify and apply different ways of storing information.
3. Extract data from dataset and apply loop and control statements.
4. Analyze data using various data manipulation tasks on the dataset.
5. Compare and contrast the data and its variations with visualization techniques.

UNIT- I: Introduction

Introduction on Essential Python Libraries- NumPy, Pandas, Matplotlib, IPython and Jupyter, SciKit-Learn, StatsModels; Declaring Variables in Python-Integer, Float, Boolean and String.
Activity I.1: Installation and Setup;
Activity I.2: Basic Exercises Using Python- Input and Output Exercise.

UNIT- II: Built-In Data Structures-I

Introduction to Loops- If, If-else, else, for and while; Introduction to Functions; Strings; Random Number Generation; Performing Basic Statistics on the Generated Random Numbers; Introduction to Built-in Data Structures- List, Dictionary, Set and Tuple;
Activity II.1: Exercise on Loops, Functions and Strings
Activity II.2: Exercises on List- List Operations and Manipulations, List Functions, List Slicing, List Comprehension.

UNIT- III: Built-In Data Structures-II

Introduction to Dictionary- Operations and Manipulations, Dictionary Functions and Comprehension; Introduction to Sets- Operations and Manipulations and Comprehension; Introduction on Tuples- Creation of a Tuple, Operations and Manipulations, Unpacking a Tuple
Activity III.1: Exercise on Dictionary and Sets
Activity III.2: Exercise on Tuples

UNIT- IV: Working With Pandas Dataframe

Loading the dataset into Pandas Data Frame; Type of the Dataset; List of Columns in the Dataset; Printing first 5 and last 5 records; Transpose Operation; Shape and Information of Dataset; Slicing and Indexing; Value Counts and Cross Tabulations; Sorting Data Frame by Column Values; Creating New Columns; Grouping and Aggregating; Joining Data Frames; Applying Different Operations; Conditional Filtering; Dropping a Column or a Row.
Case Study: World Happiness Score Data

UNIT- V: Data Visualization Using Matplotlib And Seaborn
Importance of Data Visualization in presenting a Business Problem; Types of Charts- Bar Chart, Pie Chart, Histogram, Distribution Plot, Box Plot, Comparing Distributions, Scatter Plot, Pair Plot and Heat Map. Subplots, Colors, Markers, Line Styles, Ticks, Labels and Legends, Annotations and Drawing on a Subplot
Case Study: Data Visualization of Retail Mart Data.

Text Books:

1. Gowrishankar, Veena, "Introduction to Python Programming", 1st Ed., CRC Press, 2019.
2. Fabio Nelli, "Python Data Analytics", 2nd Ed., Apress, 2018.
3. Wes McKinney, "Python for Data Analysis", 2nd Ed., OREILLY, 2017.
4. Samir Madhavan, "Mastering Python for Data Science", 1st Ed., Packt Publishing, 2015.

Suggested Readings:

1. Bhasin, "Python Basics", 1st Ed., Mercury Learning and Information, 2019.
2. Nichola Lacey, "Python by Example", 1st Ed., Cambridge University Press, 2019.
3. Robert Johansson, "Numerical Python", 2nd Ed., Apress, 2019.
4. Pratap, "Statistics for Machine Learning", 1st Ed., Packt Publishing, 2017.
5. Zed A Shaw, "Learn Python 3 the Hard Way", 1st Ed., Addison-Wesley, 2017.
6. Unpingco, "Python for Probability, Statistics and Machine Learning', 2nd Ed., Springer, 2016.

20MBE309

TRANSPORT MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To familiarize various concepts of Transport management
2. To provide in depth knowledge related to various aspects of Transportation.
3. To empower with necessary skills in different modes of Transportations.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand various concepts of Transport management.
2. Classify different modes in Transport management.
3. Apply their knowledge in various processes of Transport management.
4. Analyze different types of fright preparations in Transport management.
5. Plan and organize various systems and procedures in Fleet management.

Unit-I Introduction to Transportation

History of Transportation- Global and India, Role of Transportation in Logistics, Commerce and Industry. Principles and Practices, Scope and relationship with other logistics providers-E-commerce, 2PL, 3PL, 4PL and 5PL. Modes of Transportation – Road, Rail, Air, Ocean, Inland transportation, Multi Modal Transportation, RoRo. Process of Transportation.

Unit II Modes of Transportation

Road transport- registration of vehicle, insurance, fitness, owners of vehicle, vendorship, functions of transport organization/ truck broking agency, Different types of permits.
Air transportation- domestic/international cargo, air cargo agents/consolidators, CHAs.
Ocean transport- sea fright, liners, containers, LCL/FCL, Discounted rates.
Rail Transportation- Train racks, SLR, VPU, Express cargo trains, Private goods trains, CFS.
Refrigerated transportation, Pipe line transportation.

Unit-III Operations in Transportation

Transportation Network- Domestic and International. Process of Booking- Documents verification, Way bill (RR/LR), Acceptance of material, Preparation of consignment note, marking and labeling. Stocking, Dispatch procedure. Hub operations- Inbound, sorting/stocking, Outbound procedures. Delivery procedure- receiving, stocking, last leg/mile delivery.

Unit- IV Fright Management

Factors affecting transportation rates, fright structure, various types of rates- FTL, LTL, Sundry, express cargo transportation, liner fright rates, air cargo rates, rail cargo rates. Contractual rates, effect of fuel rates volatility on contractual rates, seasonal effects on fright rates. Effects of rates during calamities. Freight Rates- Time for Payment- Lien for freight.

Unit V Fleet Management

Planning and Resourcing: Need for Planning, Fleet management , Main types of road freight transport, Route survey and route planning, Vehicle routing and scheduling issues, Data requirements, Manual methods of vehicle routing and scheduling, Computer routing and scheduling, Periodical maintenance of fleet, SOP for vehicle maintenance, Information system applications, Integration of GPS. Long Haul, Coordination with terminals.

Text Books:

1. David Lowe, "Lowe's Transport Manager's and Operator's Handbook", 49th Edition, Kogan Page limited, 2019.
2. MB. Stroh, "A Practical Guide to Transportation and Logistics", 3rd edition, Logistics Network Inc, 2006.
3. Krishnaveni Muthiah, "Logistics Management & World Sea borne Trade", 1st Edition, Himalaya Publishing House, 2018.
4. S Jaya Krishana, Transportation Management – Imperatives and Best Practices, ICFAI University Press, 2007.

Suggested Readings:

1. B Rajashekar and G.V. R. K. Acharyulu, "Logistics and Supply Chain Management", Excel Books, 2009.
2. Alan Rushton, Phil Croucher and Peter Baker, "Logistics and Distribution Management: Understanding the Supply Chain", 5th edition, 2014.
3. Mohammad Achahchah, "Lean Transportation Management" 1st edition, Productivity Press, 2019.
4. Sudalaimutu, S and Anthony Raj, "Logistics Management for International Business" 1st edition, PHI learning, 2009.
5. S K Sarangi, "Transportation Management" 1st edition, Himalaya Publications, 2010.
6. Lora M Cecere, "Supply Chain Metrics that Matter", 1st edition, Wiley Publications, 2015.

20MBE310

DISTRIBUTION AND WAREHOUSE MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide indepth knowledge in various functions of Warehouse management and Inventory Management.
2. To deliver knowledge on various Distribution methods.
3. To educate on minimizing total physical effort and distribution Cost of Goods.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Apply their knowledge on Warehousing location, design, and operations.
2. Understand of various Inventory management systems and control.
3. Analyze different techniques to manage warehouse efficiency.
4. Make use of various techniques for optimum capacity utilization of shipping and packing.
5. Plan and select appropriate warehouse facilities management

Unit-I Introduction to Warehousing

Introduction - Warehousing, Distribution-Distribution methods-Warehouse Design- factors of warehouse design; Warehouse Location, Warehouse Operations - Warehouse Layout - Functions - Centralized and Decentralized -Warehouse operations and Storage Systems - Warehousing Cost Analysis .

Unit-II Inventory Management

Concepts - Role in Supply Chain -Role in Competitive Strategy - Functions - Types - Cost -Inventory control Models – Economic Lot size, EOQ, Economic Batch Quantity [EBQ], ROL -Reorder Level, P model, Q model, MRP, ABC analysis, Just in Time (JIT). Modern methods Kanban, DRP and ERP. FIFO, LIFO, Weighted average method. Interface between Sales and Production with SCM- Make to Stock (MTS), Make to Order (MTO), Assembly to Order (ATO), Configured to Order (CTO), Engineer to Order (ETO)

Unit-III Managing Warehouse Efficiency

Order picking - Picking methods-pick path - Measuring Warehouse Efficiency - Warehouse Workforce design and development - cross docking. Warehousing Operations: warehousing operations- inbound process, outbound processes, Functions of Warehouse- break-bulk, cross docking, order mixing, Risk management

Unit-IV Shipping and Packing

Optimum capacity utilization- Container optimization-Container loading and void fill-Weigh checking-Automated loading-Dock management-packaging-types-cost- and labelling functions and design- ASRS and their Operations – Bar Coding-Technology & Applications in Logistics Industry - RFID Technology & Applications

Unit-V Warehouse Facilities Management

Material Handling Systems - Types of Material Handling Equipment -Modern Warehousing - Types of Conveyors - Refrigerated Warehouses; Centralized and Decentralized Storage Systems: MHEs Safety & Security: types of warehousing hazards, protections taken against warehousing hazards, manual and automated MHEs in warehouse, legal requirements for ensuring a safe workplace; IT interface and Warehousing Management Systems (WMS).

Text Books:

1. Frazelle, "World Class Warehousing & Material Handling", 2nd edition, Tata McGraw-Hill, 2016.
2. Gwynne Richards, "Warehouse Management" 3rd edition, Kogan Page, 2017.
3. P Gopal Krishnan and Abid Haleem, "Hand book of Materials Management", 2nd edition, PHI learning, 2019.
4. Gopalakrishna, P. and Shandilya M.S., "Stores Management and Logistics", 1st edition, S.Chand & Co, 2013

Suggested Readings:

1. Arnold, "Introduction Materials Management", 7th edition , Pearson Education, 2011.
2. Satish K. Kapoor and PurvaKansal, Basics of Distribution Management - A Logistical Approach, 1st Edition, Prentice Hall, 2004.
3. Vinod.V.Sople, "Logistics Management", 3rd edition, Pearson Education, 2012.
4. J.P Saxena, "Warehouse Management", 1st edition, Vikas Publications, 2003.
5. Sudalaimutu, S and Anthony Raj, "Logistics Management for International Business" 1st edition, PHI learning, 2009.
6. Max Muller, "Essentials of Inventory Management" 2nd edition, Amacom, 2011.

20MBE310

DISTRIBUTION AND WAREHOUSE MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide indepth knowledge in various functions of Warehouse management and Inventory Management.
2. To deliver knowledge on various Distribution methods.
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1. Apply their knowledge on Warehousing location, design, and operations.
2. Understand of various Inventory management systems and control.
3. Analyze different techniques to manage warehouse efficiency.
4. Make use of various techniques for optimum capacity utilization of shipping and packing.
5. Plan and select appropriate warehouse facilities management

Unit-I Introduction to Warehousing

Introduction - Warehousing, Distribution-Distribution methods-Warehouse Design- factors of warehouse design; Warehouse Location, Warehouse Operations - Warehouse Layout - Functions - Centralized and Decentralized -Warehouse operations and Storage Systems - Warehousing Cost Analysis .

Unit-II Inventory Management

Concepts - Role in Supply Chain -Role in Competitive Strategy - Functions - Types - Cost -Inventory control Models – Economic Lot size, EOQ, Economic Batch Quantity [EBQ], ROL -Reorder Level, P model, Q model, MRP, ABC analysis, Just in Time (JIT). Modern methods Kanban, DRP and ERP. FIFO, LIFO, Weighted average method. Interface between Sales and Production with SCM- Make to Stock (MTS), Make to Order (MTO), Assembly to Order (ATO), Configured to Order (CTO), Engineer to Order (ETO)

Unit-III Managing Warehouse Efficiency

Order picking - Picking methods-pick path - Measuring Warehouse Efficiency - Warehouse Workforce design and development - cross docking. Warehousing Operations: warehousing operations- inbound process, outbound processes, Functions of Warehouse- break-bulk, cross docking, order mixing, Risk management

Unit-IV Shipping and Packing

Optimum capacity utilization- Container optimization-Container loading and void fill-Weigh checking- Automated loading-Dock management-packaging-types-cost- and labelling functions and design- ASRS and their Operations – Bar Coding-Technology & Applications in Logistics Industry - RFID Technology & Applications

Unit-V Warehouse Facilities Management

Material Handling Systems - Types of Material Handling Equipment -Modern Warehousing - Types of Conveyors - Refrigerated Warehouses; Centralized and Decentralized Storage Systems: MHEs Safety & Security: types of warehousing hazards, protections taken against warehousing hazards, manual and automated MHEs in warehouse, legal requirements for ensuring a safe workplace; IT interface and Warehousing Management Systems (WMS).

Text Books:

1. Frazelle, "World Class Warehousing & Material Handling", 2nd edition, Tata McGraw-Hill, 2016.
2. Gwynne Richards, "Warehouse Management" 3rd edition, Kogan Page, 2017.
3. P Gopal Krishnan and Abid Haleem, "Hand book of Materials Management", 2nd edition, PHI learning, 2019.
4. Gopalakrishna, P. and Shandilya M.S., "Stores Management and Logistics", 1st edition, S.Chand & Co, 2013

Suggested Readings:

1. Arnold, "Introduction Materials Management", 7th edition , Pearson Education, 2011.
2. Satish K. Kapoor and PurvaKansal, Basics of Distribution Management - A Logistical Approach, 1st Edition, Prentice Hall, 2004.
3. Vinod.V.Sople, "Logistics Management", 3rd edition, Pearson Education, 2012.
4. J.P Saxena, "Warehouse Management", 1st edition, Vikas Publications, 2003.
5. Sudalaimutu, S and Anthony Raj, "Logistics Management for International Business" 1st edition, PHI learning, 2009.
6. Max Muller, "Essentials of Inventory Management" 2nd edition, Amacom, 2011.

SCHOOL OF MANAGEMENT STUDIES CBIT HYDERABAD

20MBE401

FINANCIAL RISK MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To make the Students understand the various facets of Risk Management.
2. To provide indepth the concept of Derivatives and its various types.
3. To familiarize the Students about Forwards, Futures, Swaps and Options.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the measures and differentiate between different types of Risks that an Organization faces.
2. Have a comprehensive view about types of Derivatives and their Trading and Settlement.
3. Evaluate Forwards and Futures Contracts and Hedging Strategies.
4. Comprehend the computational aspects of Swaps and the associated Risk.
5. Evaluate various Option Trading Strategies and select the suitable one for the given situation.

Unit-I Introduction

Concept, Nature, Source, Measurement, Identification and Evaluation of Risk. Types of Risk. Possible Risk Events, Risk Indicators, Risk Management Process- Pre-requisites and fundamentals. Misconceptions of Risk. An Integrated Approach to Corporate Risk Management. Management of Interest Rate Risk, Credit Risk and Exchange Rate Risk. Non-Insurance methods of Risk Management- Risk Avoidance, Loss Control, Risk Retention and Risk Transfer.

Unit-II Derivatives

Development and Growth of Derivative Markets, Types of Derivatives, Uses of Derivatives, Types of Traders- OTC and Exchange Traded Securities- Types of Settlement- Fundamental linkages between Spot and Derivative Markets, The Role of Derivatives Market, Uses and Misuses of Derivatives.

Unit–III Forward and Futures

Forwards: Definition- Features and pay-off profile of Forward Contracts. Valuation of Forward contracts. Forward contracts to manage Commodity Price Risk, Interest Rate Risk and Exchange Rate Risk.

Features: Definition- Specifications of Futures Contract - Margin Requirements- Marking to Market- Basis and Convergence of Future price and Spot price. Valuation of Future Contracts- Types of Futures Contracts- Securities, Stock Index Futures, Currencies and Commodities- Hedging Strategies- Hedge ratio. Difference between Forwards and Futures Contracts.

Unit-IV Swaps

Concept and Nature- Evolution of Swap Market- Features of Swaps- Major Types of Swaps: Interest Rate Swaps- Currency Swaps- Commodity Swaps- Equity Index Swaps. Credit Risk in Swaps- Credit Swaps- using Swaps to Manage Risk- Pricing and Valuing Swaps.

Unit-V Options

Definition- Exchange Traded Options, OTC Options – Specifications of Options – Call and Put Options- American and European Options – Intrinsic Value and Time Value of Options – Option payoff, Options on Stock Indices and currency. Option Pricing Models: The Binominal Option Pricing Model (BOPM): Assumptions and problems - single and two period models. The Black and Scholes Option Pricing Model (BSOPM): Assumptions and problems.

Text Books:

1. John C. Hull & Sankarshan Basu, "Options, Futures and Other Derivatives", 10th Ed, Pearson Education, 2017.
2. S.K.Mishra, "Derivatives and Risk Management", 2nd Ed., Everest Publishing House, 2010.
3. Sundaram Janakiramanan, "Derivatives and Risk Management", Pearson Education, 2011.
4. Rajiv Srivastava, "Derivatives and Risk Management", 2nd Edition, OUP India, 2013.

Suggested Readings:

1. Paul Hopkins, Kogan Page, "Fundamentals of Risk Management", 4th Ed., Institute of Risk Management, 2017.
2. Jean-Philippe Bouchaud and Mark Potters, "Theory of Financial Risk and Derivative Pricing", 2nd Ed. Cambridge press, 2009.
3. David. A. Dubofsky& Thomas. W. Miller, Jr., "Derivatives Valuation and Risk Management", Oxford University Press, 2003.
4. R. Madhumathi, M. Ranganatham, "Derivatives and Risk Management", Pearson Education, 2012.
5. Prakash B Yaragol, "Financial Derivatives Text & Cases" First Edition, Vikas Publishing House, 2018.
6. S.L. Gupta, "Financial Derivative Theory, Concepts and Problems", 9th printing, PHI Learning private limited, 2010.

20MBE402

PROJECT APPRAISAL AND FINANCING

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide basic knowledge of Project Planning in addition to the ideas for Generation and Screening of the projects.
2. To deliver varied aspects of Projects in terms of Market, Demand, Technical and Financial.
3. To illustrate the Structure of Financial Institutions in India and Human Aspects of Project Management.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Have a comprehensive view on project Planning and analysis along with ideas for generation and screening of the projects.
2. Understand the important facets of Market, Demand and Financial Analysis of the projects.
3. Understand the Feasibility Analysis and Find out the cash flows of the project.
4. Incorporate Risk Sensitivity, Scenario Analysis and Simulation Analysis for Managing Risk in the project appraisal decision.
5. Analyze projects in the Public Domain with special reference to Social Cost Benefit Analysis and understanding Corporate Governance in India.

Unit-1 Introduction to Project Planning

Levels of Decision Making- Key Issues in major Investment Decisions- Interface between Strategic Planning and Capital Budgeting. Generation of Ideas – Monitoring the environment - Corporate Appraisal - Preliminary Screening - Project rating index - Sources of positive NPV -Qualities of a Successful Entrepreneur.

Unit-2 Market Analysis and Demand Analysis

Market and demand analysis: Process. Technical Analysis: Manufacturing Process and technology -Study of Material Inputs and Utilities – Product Mixes - Plant Capacity - Location and Site - Machinery and Equipment - Structures and Civil Works - Project Charts and Layouts- Schedule of the project Implementation.

Unit-3 Financial Analysis

Financial Analysis: Estimation of cost of project and means of financing - Estimates of Sales and Production - Cost of production - Working Capital requirement and its financing - estimates of working results –Projected cash flow statement - Projected balance sheet. Project cash flows: Basic principles of measurement of cash flows - Components of the cash flow streams - Viewing a project from different points of view - Definition of cash flows by Financial Institutions and Planning Commission - Biases in Cash Flow estimation.

Unit-4 Project Risk Analysis

Source and Measure of Risk - Sensitivity Analysis - Scenario Analysis, Simulation analysis–Managing risk - Selection of Project - Risk Analysis in practice. Special Decision Situations: Choice between Mutually Exclusive Projects of unequal life - Optimal Timing Decision - Determination of Economic Life - inter-relationships between Investment and Financing aspects.

Unit-5 Project Management and Corporate Governance

Project Management: Structure of Financial Institutions in India. Rationale for Social Cost Benefit Analysis (SCBA) – UNIDO Approach - Little and Mirle Approach. Forms of Project Organization - Project Planning, Project Control, Human aspects of Project Management - Prerequisites for successful Project Implementation. Corporate Governance: Introduction - Major Corporate Governance Failures- Need for Corporate Governance in India, Theories of Corporate Governance - Agency Theory, Stewardship Theory, and Stakeholder Theory - Convergence- Problems of Governance in Companies.

Text Books:

1. Prasanna Chandra, "Projects: Planning, Analysis, Selection, Financing, Implementation and Review", McGraw-Hill Education, 8th edition, 2015.
2. Bob Tricker, "Corporate Governance Principles, Policies, and Practices", Oxford University Press, 2015.
3. Ambrish Gupta, "Project Appraisal and Financing", PHI Learning, 2017.
4. John Bartlett, "Project Risk Analysis and Management Guide", APM Publishing Ltd, second edition, 2004.

Suggested Readings:

1. Choudhary S., "Project Management", Mc-Graw Hill, 2006.
2. Desai, Vasant, "Project Management", Himalaya Publishing House, 2006.
3. Machiraju, H.R.: "Introduction to Project Finance", Vikas Publishing House.
4. N. Balasubramanian, "Corporate Governance and Stewardship", TMH, 2012.
5. Rashmi Agrawal, Yogieta S Mehra "Project Appraisal & Management", Taxmann's,2017.
6. David Hillson, "Managing Risk in Projects", Gower Publishing Company, 2009.

20MBE403

INDUSTRIAL RELATIONS AND LABOUR LAWS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the course are:

1. To develop an understanding of the basics of industrial relations Concepts.
2. To introduce them the concepts of Trade Unions and Labour Administration Machinery.
3. To discuss the importance and various provisions of labour laws in the Digital Era.

Course Outcomes: After completion of the course, student will be able to:

1. Apply the knowledge of basics and approaches of industrial relations in real time situations.
2. Understand the dynamics of trade unions and their recognition for successful negotiations.
3. Appraise the process of labor administration and labour policy in the Digital Era.
4. Develop Strategies to deal with various parties involved in Industrial Relations.
5. Interpret and Implement various updated provisions related to Labour Laws.

Unit-I Industrial Relations Perspectives

Conceptual framework and approaches to Industrial Relations–Influence of Emerging socioEconomic scenario on growth of Industrial relations in India-Factors influencing Industrial Relations in India-Differences in perspectives –Industrial relations and Employee relations. Industrial Relations for Startup's,and Small Firms, Future of Employee relations. Industrial conflict-Types and causes of Industrial disputes - Machinery for prevention and settlement of Industrial disputes. Recent Amendments.

Unit-II Trade Unions

Structure, characteristics and Functions of Trade Union; Trade union act-1926-problems of Trade union recognition and government policy- Recognition of Trade unions as collective bargaining agents-Problems and issues involved in collective bargaining process-Role of collective bargaining in promoting Industrial amity and peace-Industrial Employment(standing orders) Act-1946. Recent Amendments.

Unit-III Labour legislation Administration

Importance of Labour laws, The classification of labour laws-Labour administration-Evolution of labour administration in India-Labour policy in India-Judiciary and the child labour-Right to education and child labour-Public interest litigation and child labour-Labour administrative machinery of the government-Role of ILO in Labour administration. Changing Business Environment and labour laws- Digital Transformations in the Industrial Relations Context ,WTO and social clause. Recommendations of II National commissioner on Labour. Recent Amendments.

Unit-IV Employee Benefits

Defining and Exploring employee benefits-Employee benefits practice-Legal and discretionary benefits practice-The economics of employee benefits-Regulating employee benefits-social security legislations-The ESI Act-1948-The Maternity benefit act-1961-The workmen's compensation act-1923-The payment of gratuity act-1972-Employee provident fund and miscellaneous provisions act1952. -Recent Amendments.

Unit-V Wage legislation and administration

The need and importance of Wage legislation - Payment of Wages Act 1936 -The minimum wages Act 1948 - The payment of Bonus Act 1965- Equal remuneration Act 1976 - The context and concept of wage - Wage administration in India - Components and the determinants of wage - Wage structure towards a wage policy- Recent Amendments.

Text Books:

1. C.B. Mamoria, Satish Mamoria, P. Subba Rao, "Dynamics of Industrial Relations", Himalaya Publishing House, 16th Edition, 2020.
2. C.S. Venkat Rathnam, Manoranjan Dhal, "Industrial Relations", Oxford University Press - New Delhi, 2nd Edition, 2017.
3. S.C. Srivastava, "Industrial Relations and Labour Laws", Vikas Publishing House, New Delhi, 7th Edition, 2019.
4. P.N. Singh and Neerajkumar, "Employee relations Management", Pearson Education, New Delhi, 1st Edition, 2011.

Suggested Readings:

1. Joseph J. Mortocchio, "Employee Benefits", Tata McGraw Hill, New Delhi, 6th Edition, 2017.
2. Monappa, Ranjeet Nambudiri, Patturaja Selvaraj, "Industrial Relations and Labour Laws", Mc Grawhill Education, 2nd Edition, 2012.
3. P.K. Padhi, "Labour and Industrial Laws", PHI Learning Pvt. Ltd., 3rd Edition, 2017.
4. Al Rainnie, "Industrial Relations in Small Firms: Small Isn't Beautiful", Routledge Library Editions, 1st Edition, 2016.
5. Susan Hayter, Chang-Hee Lee, Elgar, "Industrial Relations in the Emerging Economies-The Quest for Inclusive Development", Edward Elgar Publications, 1st Edition, 2018.
6. Venkat Venkat Raman, "The Digital Matrix: New Rules for Business Transformation through Technology", Lifetree Media, Penguin Random House India, 1st Edition, 2017.

20MBE404

STRATEGIC HUMAN RESOURCES MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the course are:

1. To give an understanding of the concept and importance of strategic Human Resources management in an Organization.
2. To discuss the importance of Strategic Human Resources Planning with a focus on forecasting the demand and supply of Human Resources in an organization.
3. To showcase how the SHRM can be implemented with an emphasis on HR functions and to make the students aware about the need for Strategy Evaluation in an Organization.

Course Outcomes: After completion of the course, student will be able to:

1. Analyse strategic role of Human Resources management in an Organization.
2. Assess various environmental factors that affect SHRM Practices.
3. Appreciate and manage the managerial issues in SHRM.
4. Draft an efficient Human Resources Plan that contributes to effective management of resources.
5. Design required HR functional strategies to support SHRM practices in the organization and effectively evaluate SHRM practices by adopting an appropriate approach depending on the nature of strategy adopted.

Unit- I Introduction

Introduction to business and corporate strategies; HR Strategies to increase firm performance-Integrating HR strategies with business strategies, HR as a Strategic Partner: The Measurement Challenge-Implementation of SHRM: Process based approach. Strategic role of HRM, over view of Planning and Implementing HR Strategy, Emerging issues in SHRM.

Unit- II Strategic Human Resource Environment

Technology, structure-Workforce diversity; Demographic trends, Temporary & contract Labour - Management Trends: Introduction, Changing Environment, Business Complexities, Portfolio, Process and Structure related Strategic responses, Multinational, Global and Transnational strategies in HRM, Global environment-International Developments.

Unit- III SHRM Planning

The strategic role of HR Planning- Overview of HR planning - Managerial Issues in Planning: Personal Implications, Changing Receptivity-Selecting Forecasting Techniques: Purpose of planning, Organizational and Industry Characteristics, Environmental Turbulence and Other Considerations-Forecasting the Supply of Human Resources: Replacements Charts, Succession Planning, Markov Analysis, Renewal Models, computer simulation and Utilization of Supply Forecasting Techniques-Forecasting the Demand for Human Resources, Expatriation and repatriation management in global HRM.

Unit-IV Strategy Implementation

Efficient Utilization of Human Resources-Dealing with employee shortages and Surpluses: Recruitment & Retention strategies, training & development strategies: An overview of performance management strategies and reward &compensation strategies-Retrenchment strategies - Special Implementation Challenges: Career paths for Technical Professionals, Dual- Career Couples, Strategies for future corporate- Virtual Corporation.

Unit- V Human Resource Evaluation

Overview of Evaluation: scope, Strategic Impact, Levels of Analysis-Criteria, Levels of Constituents and Ethical Dimensions-Approaches to Evaluation: Audit, Analytical, Quantitative and Qualitative Approaches-Outcome and process criteria-Balance Scorecard Perspective-Bench marking-Industry Influences. Prevalence of Evaluation. Evaluating Strategic Contributions in Emerging Areas

Text Books:

1. Charles R. Greer, Strategic Human Resource Management, Pearson Education, 2004.
2. Jeffrey A Mello, Strategic Human Resource Management, South-western Publications, 2012.
3. Srinivasan Kandula, Human Resource Management in Practice, Prentice Hall of India, 2005
4. Michael Armstrong, Angela Baron, Handbook of Strategic HRM, Jaico Publishing House, 2006.

Suggested Readings:

1. Gary Dessler, Biju Varrkey, Human Resource Management, Pearson Education, 2017.
2. Rosemary Harrison, Employee Development', University Press, India Ltd., 2013.
3. Luis R. Gomez-Mejia, David B. Balkin, Robert L. Cardy, Managing Human Resources, PHI, 2001.
4. Peter J. Dowling, Denice E. Welch, Randall S. Schuler, International Human Resource Management, Thomson South-Western, 2002.
5. Anuradha Sharma, Aradhana Khandekar, Strategic Human Resource Management- An Indian Perspective, First Edition, Sage Publications, 2006.
6. Graeme Salaman, John Storey, Jon Billsberry, Strategic Human Resource Management, Sage Publications, 2005.

20MBE405

CONSUMER BEHAVIOUR

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To give the perspective of Consumers, their Buying Behaviour patterns and address the importance of environmental influences on volatile Consumer Behaviour.
2. To get the students acquainted with the concepts of Consumer Motivation, Personality, Perception and its implication that help them in obtaining knowledge on individual determinants of Consumer Behaviour.
3. To enable students to understand the consumer decision making process and gain insights about the models of Consumer Behaviour comprehensively.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the concepts to be applied to Marketing strategy.
2. Analyze the environmental factors affecting Consumer Buying Behaviour and learn the impact of socio-cultural settings on the consumption behaviour.
3. Develop the Marketing Strategies by applying the dynamics that influence consumers in taking decisions.
4. Analyze the challenges that might influence the formulation of effective Marketing Strategies from a Consumer Behaviour perspective.
5. Evaluate the dynamics of Human behaviour and the basic factors that influence the Consumer Decision Process.

Unit-I Introduction

Introduction, Definition, Customers and Consumers, Consumer Behavior and its Applications, Evolution of Consumer Behaviour, Market Research and Consumer Behaviour, Market Segmentation and Positioning, Consumer Behaviour Model.

Unit-II Environmental Influences on Consumer Behaviour

Culture - Definition, Characteristics, Cross-Cultural understanding of Consumer Behaviour; Subcultures - Nature. Social Class - Process of Social Stratification, Nature, Measurement and Categorization, Social Class and Consumer Behaviour. Social Groups - Group, Classification of Groups, Group Properties, Reference Groups- Nature. Family - Significance, Family Life Cycle, Family Purchasing Decisions. Personal Influence and Diffusion of Innovations - Nature and Significance, Communication and Influence Flow, Opinion Leadership, Adoption and Diffusion of Innovations.

Unit-III Individual Determinants of Consumer Behaviour

Personality and Self-Concept- Personality Theories and Applications, Personality and Marketing, Self-Concept and Consumer Behaviour; Motivation and Involvement - Nature and Role of Motives, Dimensions of Involvement. Information Processing - Information Acquisition, Perceptual Encoding, Marketing Implications. Learning and Memory - Characterizing Learning, Classifying Learning, Characteristics of Memory Systems, Retrieval of Information. Attitudes - Characteristics, Functions, Sources of Attitude Development, Attitude Theories and Models.

Unit-IV Consumer Decision Processes

Problem Recognition- Types, Situations, Results, Marketing Implications. Search and Evaluation – Information Search Process, Information Evaluation Process, Marketing Implications. Purchasing Processes – Choosing a Store, In-Store Purchasing Behaviour, Nonstore Purchasing Processes, Purchasing Patterns. Post Purchase Behaviour – Postpurchase behavior, Product Disposition.

Unit-V Models of Consumer Behaviour

Traditional Models of Consumers-Microeconomic Model, Macroeconomic Model. Contemporary Models – Nicosia Model, Howard-Sheth Model, Engel-Kollat-Blackwell- Model, Sheth Family Decision Making Model, Bettman's Information Processing Model, Sheth-Newman-Gross Model of Consumption Values

Text Books:

1. Loudon, L. D., & Albert, J. Della Bitta, "Consumer Behaviour", 4th edition, Tata Mcgraw Hill, Reprint 2017.
2. Schiffman and Kannik, Consumer Behaviour, 11th edition, Pearson Edition, 2015.
3. Black-well, R.Miniard PW and Engel, Consumer Behaviour, Thompson learning, 2010.
4. Kumar Dinesh, Consumer Behaviour, 1st edition, Oxford publication, 2015.

Suggested Readings

1. Solomon, M. R., Consumer behaviour: buying, having, and being, 11th edition, Pearson Education India, 2015.
2. Leon G. Schiffman, J. Wisenblit and S. Ramesh Kumar, Consumer Behavior, 12th edition, Pearson Education, 2018.
3. Kardes, Frank R, Consumer Behavior and Managerial Decision Making, 2nd Edition, Pearson, 2001.
4. Suja R .Nair, Consumer Behaviour in Indian Perspective, HPH, 2013.
5. Sheth and Mittal, Consumer Behaviour Thompson learning, 2015.
6. Gupta, S. L., & Pal, S., Consumer Behaviour- An Indian perspective, Text and cases, 2nd edition, Sultan Chand & Sons, 2013.

20MBE406

SERVICES AND RETAIL MARKETING

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To familiarize with characteristics of services, retail marketing concepts and make them understand the concepts of services and retail industry and provide insight into the marketing mix for services and service quality.
2. To educate on strategies to deal with characteristics of services and concept of services marketing triangle.
3. To create awareness on retail formats, theories and discuss the issues relating to merchandise management, emerging concepts.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand overview of services and retail and its significance.
2. Understand concepts of service, challenges in delivering quality services and retail industry trends.
3. Apply suitable marketing mix for various services and develop strategies to deal with characteristics of services.
4. Design unique retail formats considering the need of the customers.
5. Analyze consumer evaluations of retail offerings and apply retail concepts to real situations and formulate retail marketing strategies for the success of retail industry.

Unit-I Introduction

Service Sector - Indian Scenario and Global Issues, Services Concepts- Scope of Goods and Services, Goods-Services continuum, 4Is of Services, Goods and Services Categorization, Industrial Services.
Retailing - Meaning, Evolution, Functions, Types, significance of retail industry, Organized vs Unorganized retailing, Retailing in India- Scenario, Factors affecting Retailing in India, Retailing Opportunities in India.

Unit- II Service marketing Mix and Service Quality

Services Marketing Mix: Product, Pricing, Place, Promotion, People, Physical evidence and Process.
Service Quality- Dimensions of Quality, Understanding Quality Management. Measuring Service Quality.

Unit- III Strategies for Service Marketing

Overview, Strategies for dealing with Intangibility, Inventory, Inconsistency and Inseparability. Loyalty, Switching, Intention to Stay, TAM (Technology Adoption Model). Service Marketing Triangle- External Marketing, Internal Marketing, Interactive Marketing.

Unit-IV Retail Marketing

Retail formats, Retail Pricing Strategies, role of franchising in retail, Technology in retail, Factors affecting retail. Retail Pricing - The concept of retail pricing and the factors affecting price, elements of retail price, developing a pricing strategy, adjustment to retail price. CRM in retailing. E-tailing- Issues and Challenges.

Unit-V Merchandise Management

Sources of Merchandise, Merchandise Presentation Techniques, Category Management, Store Layout and Visual Merchandising – Fundamental of Store Design, Types of Display Areas, Space Planning, Point of Purchase, Retail Operations – Controlling Store Operations, Customer Service – Gathering Customer Information, Understanding Customer, Service offered, Customer Evaluation, Building a Sustainable Advantage, Customer Complaints, Retail Selling – Qualities required for Retail Selling, The Selling Process.

Text Books:

1. Rampal M. K and Gupta S. L, Services Marketing Concepts, Applications and Cases. Galgotia Publishing Company - New Delhi, 2008.
2. S.M.JHA, Services Marketing HPH, Mumbai, 2009.
3. A J Lamba, The Art of Retailing. TMH, 2009.
4. Levy and Weitz, Retailing. TMH, 2009.

Suggested Readings:

1. Zeithaml, V.A., Bitner, M. J., Gremler, D. D. & Pandit, A, Services marketing, 6th edition, Indian Edition, Tata McGraw-Hill, 2013.
2. Christopher Lovelock, Jochen Wirtz, Jayanta Chatterjee, Services Marketing: People, Technology, Strategy, 7th edition, Pearson Ed., 2011.
3. David Gilbert, Retail Marketing Management, 2nd Edition, Pearson Education, 2006.
4. Barry, B. and Evans, J, Retail management: A Strategic Approach, 12th edition, Pearson Education India, 2012.
5. Michael Levy, Barton A. Weitz, Ajay Pandit, Retailing Management, Special Indian edition, 8th edition, Tata McGraw-Hill Education, 2017.
6. Piyush Kumar Sinha and Dwarika Prasad Uniyal, Managing Retail, 2nd edition, Oxford University Press, 2012.

SCHOOL OF MANAGEMENT STUDIES CBIT Hyderabad

20MBE407

MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To understand the various Machine Learning Algorithms.
2. To familiarize various Classification Techniques and Recommender Systems.
3. To get the students acquainted with the concepts of different searching techniques of AI systems.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand complexity of Machine Learning algorithms.
2. Apply common Machine Learning algorithms in solving the business problems.
3. Differentiate various Machine Learning solutions
4. Understand the fundamental principles of intelligent systems.
5. Evaluate the various search mechanisms and design a Chatbot.

Unit–I Machine Learning

What is Machine Learning; Types of Machine Learning Algorithms- Supervised, Unsupervised and Reinforcement Learning.

Supervised Learning- K Nearest Neighbors, Random Forest and Boosting

Case Study: Predicting Employee Churn Using KNN, RF and Boosting.

Unit-II Recommender Systems Using Machine Learning

User Based Similarity- Calculating Cosine Similarity Between Users, Filtering Similar Users, Challenges with User Based Similarity. Item Based Similarity- Calculating Cosine Similarity between Movies, Finding Most Similar Movies. Matrix Factorization

Case Study: Application of Recommender System using Netflix Movie Recommender Data.

Unit-III Decision Tree Classification

Introduction to Decision Tree; Building Decision Tree Classifier using Gini Criteria; Measuring Test Accuracy; Displaying the Tree; Building Decision Tree Classifier using Entropy Criteria; Finding Optimal Criteria; Maximum Depth of the Tree and Benefits and Disadvantages of Decision Tree

Case Study: Applying Decision Tree Classification on German Credit Data.

Unit- IV Artificial Intelligence

Introduction- Meaning and Foundations of AI, History of AI. Intelligent Agents- Agents and Environments, Concept of Rationality, Nature of Environments, The Structure of Agents, AI: The present and Future. Problem Solving-I: Solving Problems by Searching- Problem Solving Agents, Searching for Solutions, Uninformed Search Strategies, Informed Search Strategies, Heuristic Functions.

Unit-V Problem Solving

Beyond Classical Search- Local Search Algorithms and Optimization Problems, Beyond Classical Search, Adversarial Search, Constraint Satisfaction Problems, Chatbot –Introduction, Characteristics and its importance.

Text Books:

1. Wei- Meng Lee, "Python Machine Learning", Weily, 3rd Ed., 2019.
2. Rich, Knight, Nair, "Artificial Intelligence", Tata McGraw Hill, 3rd Ed., 2017.
3. Tom M. Mitchell, "Machine Learning", McGraw Hill, 4th Ed., 2017.
4. Russell, Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Ed., 2015.

Suggested Readings:

5. Paul Deitel, Harvy Deitel, "Python for Programmers- with introductory AI Case Studies", 1st Ed. Pearson Education, 2019.
6. Puneet Mathur, "Machine Learning Applications Using Python: Cases Studies from Healthcare, Retail, and Finance", 1st Ed., Apress, 2019.
7. Joshua Eckroth, "Python AI Projects for Beginners", 1st Ed., Packt Publishers, 2018.
8. Shalev-Shwartz, Ben-David, "Understanding ML from Theory to Algorithms", 1st Ed., Cambridge University Press, 2014.
9. Stephen Marsland, Machine Learning - An Algorithmic Perspective, 2nd Ed., CRC Press, 2014.
10. Saroj Kaushik, "Artificial Intelligence", 1st Ed., Cengage Learning India, 2011.

20MBE408

CLOUD COMPUTING

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:
1. To impart the basics of cloud computing for business management.
2. To illustrate and explore the benefits of cloud storage and its applications, usage by managers.
3. To enable students explore cloud computing driven real time systems.

Course Outcomes: After Completion of the Course, Students will be able to:
1. Understand the characteristics and models in Cloud computing.
2. Asses Cloud services applications and the challenges associated with Cloud Computing.
3. Apply various cloud services and deployment models and virtualization techniques for business.
4. Analyze the concepts of cloud storage and demonstrate their use.
5. Evaluate various cloud programming models and apply them in virtual office management.

Unit–I Introduction to Cloud Computing
Evolution - Cloud Computing, Hardware, Internet and Software, Virtualization. Cloud service Attributes: Access to the cloud, Cloud Hosting, Information technology support. Characteristics of Cloud Computing: Rapid Elasticity, Pay per use, Independent Resource Pooling, Network Access, Web Services on Cloud

Unit-II Cloud Services Applications
Cloud Delivery Models- Infrastructure-as-a-Service, Platform-as-a-Service, Software-as-a-Service. Cloud Categories: Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud. Applications – Online Planning and Task Management –Event Management – CRM. Cloud Service Development tools - Word Processing, Databases, Storing and File Sharing on Cloud

Unit-III Cloud Computing For Managers
Centralizing Email Communications – Collaborating on Schedules - To-Do Lists, Contact Lists. Online Community development, Online collaboration tools for Projects, Cloud Computing for Business

Unit-IV Cloud Management
Privacy and its relation to Cloud-based Information Systems. Security in the Cloud: Data Security and Control, Provider Loss, Subpoenaed Data, Lack of Provider Security, Encryption. Common Standards in the Cloud, End-User Access to the Cloud Computing, Legal and Ethical dimensions, Cloud Pricing Models.

Unit–V Virtual Office Management
Web-based communication tools, Web Mail Services, Web Conference Tools, Social Networks and Groupware, collaborating via blogs and Wikis, IBM, Amazon Ec2, Google Apps for Business

Text Books:

1. John W. Rittinghouse and James F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, Taylor & Francis Group, Boca Raton London, 2010.
2. Kumar Saurahb, "Cloud Computing – Insights into new era infrastructure", Wiley India, 2nd Edition.
3. Michael Miller, "Cloud Computing: Web-Based applications That Change the Way You Work and Collaborate Online", Que Publishing, 2009
4. Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for Ondemand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, July 2008.

Suggested Readings:

1. Alfredo Mendoza, "Utility Computing Technologies, Standards, and Strategies", Artech House INC, 2007.
2. Bunker and Darren Thomson, "Delivering Utility Computing", John Wiley & Sons Ltd, 2006.
3. Igor Fyanberg, Hui-LanLu, Dorskuler, "Cloud Computing business Trends and Technologies", Wiley Publishers,2016.
4. Michael Hugos , "Business in the Cloud", John Wiley & Sons Ltd., 2011.
5. Joe Wienman, "Cloudonomics: The Business value of cloud computing", John Wiley & sons Ltd, 2012.
6. Anthony T.Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", MCgraw Hill Publishers, 2010.

20MBE409

E-COMMERCE LOGISTICS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To explain the various concepts of E-commerce logistics.
2. To familiarize with various operations and warehousing technologies in E-Commerce Logistics.
3. To provide application knowledge on network design and automation in E-Commerce Logistics.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand E-commerce and E-commerce logistics and its terminologies.
2. Understand and choose appropriate fulfillment centre for e-commerce logistics.
3. Applying various techniques in e-commerce logistics warehousing and consignment movement process.
4. Build suitable warehouse network design and application of automated technologies in handling of consignment.
5. Utilizing various technologies associated with E-commerce logistics.

Unit I History of E- commerce Logistics

The Evolution of Logistics and supply chain from Direct to Store models to E-Commerce, Meaning – functions and special characteristics of E-commerce, E-commerce in India, E-commerce and its technological aspects, overview of developments in information technology and e-commerce: Scope of E commerce, benefits and limitations of E-commerce. Role of Logistics in E- commerce, emergence of E-commerce logistics specialists.

Unit II E-Commerce and Fulfilment centres

Understanding E-Commerce fulfilment centres, definition and process, Faster order fulfil filament process, Real time decision support, Difference between distribution centre and fulfilment centre, Mega e-fulfilment centres, Strategies in E-commerce fulfilment, In-house order fulfilment, Managing inventory with outsourced fulfilment centre, end to end E-commerce logistics, E-commerce retail logistics

Unit-III Operations in E- Commerce Logistics

Inventory management, Parcel hubs/sortation centres warehousing, packaging, labelling, private labelling and manufacturing, white libelling, billing, shipping, payment collection, return, and exchange. Operating models: The marketplace model, Inventory-led model, Fulfilled by e-retailer drop ship model; Capacity and load matching, Track and tracing of consignments, managing on time deliveries. Dynamic Logistics alliance/integration in e-commerce.

Unit-IV Network and warehouse design

Distribution global network, retail distribution network, direct store delivery, automation in distribution, automated picking technology, distribution centre design, implementation of warehouse management systems, science of warehouse slotting optimization, grocery/industrial distribution. Robot in fulfilment operations, ASRS, yard management, network locations, E-commerce retail logistics activities, First mile logistics Fulfilment, Line haul management.

Unit-V Logistics solutions for E-commerce

Logistics solutions for e- commerce, demand planning, tracking, pre-shipping, last mile delivery-COD-managing returns, dedicated customer support,3rd party shipping carrier, subscription model Order, Invoice management system, Omni channel e-commerce, POS (Point of Sales) e commerce integration system, Emerging trends in Voice commerce, E-commerce SEO, Seamless interface with existing SCM or ERP system logistics, E- commerce and consumer buying habits.

Text Books:

1. Paul T Sudhakar, "Logistics in E-Commerce Business", 1st edition, Create space Independent Publication, 2017.
2. Deborah L. Bayles, "E-commerce logistics and fulfilment: Delivering the goods", 1st edition, Prentice Hall, 2000.
3. P. T. Joseph, "E-Commerce: An Indian Perspective", 5th edition, PHI Learning, 2015
4. Deryn Graham, "E-logistics and E-supply Chain Management: Applications for Evolving Business", Business Science Reference, 2013.

Suggested Readings

1. Geunes, J., Akçali, E., Pardalos, P., Romeijn, H.E., and Shen, Z.-J.M. (Eds.), "Applications of Supply Chain Management and E-Commerce Research" Springer, 2005.
2. Janice Reynolds, "Logistics and Fulfilment for e-business", 1st edition, CRC Press, 2001.
3. Frazelle, "World Class Warehousing & Material Handling", 2nd edition, Tata McGraw-Hill, 2016.
4. Gwynne Richards, "Warehouse Management" 3rd edition, Kogan Page, 2017.
5. P Gopal Krishnan and Abid Haleem, "Hand book of Materials Management", 2nd edition, PHI learning, 2019.
6. Gopalakrishna, P. and Shandilya M.S., "Stores Management and Logistics", 1st edition, S.Chand & Co, 2013.

20MBE410

INTERNATIONAL LOGISTICS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

4. To provide insights of International logistics operations.
5. To impart knowledge of International fright structure.
6. To focus on different types of containers and its transportation.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand various terminologies of global logistics.
2. Analyze various shipping methods in Air and Ocean transport.
3. Apply knowledge in various systems and procedures of international trade.
4. Choose appropriate international insurance and packing methods.
5. Categorize fright structure in international logistics.

Unit I Introduction

Global supply chain – Its importance in a Global economy – Stages in International Development - Export/ Import, Terms and conditions of purchase of sales, method of payment, etc.), Quality considerations (e.g. ISO9000, industry quality specifications, etc, Security issues.). Role of Clearing Agent, Role of IATA and TIACA in Air Cargo Industry, International Air Transport; Exim policies.

Unit II Modes of International Transportation

Types and Terminology- Features, Advantages and Disadvantages of using sea mode, Classification of ships, Shipping Methods, S wage in Ship, Major Sea-routes around the world, Parties and Perils Associated with Sea Mode; Maritime Risks, Marine Insurance. Air cargo industry, International Air Transportation, Models in Air cargo planes.

Unit III Containerization in International Trade

Containerization and Chartering Containerization: Genesis, Concept, Classification, Benefits and Constraints; Inland Container Depot (ICD): Roles and Functions, CFS, Export Clearance at ICD; CONCOR; ICDs under CONCOR; Chartering: Kinds of Charter, Charter Party, and Arbitration. Export and Import procedure in India, Transport Documents, Mate Receipt, Bill of Lading - features and types, Air-way Bill.

Unit-IV Insurance Regulation and Packing

International insurance- risk management, Insurance and transportation liability regimes- marine insurance policies-coverage under a marine cargo insurance policy – airfreight policy- Lloyd's principles, Baltic exchange, UN convention on liner code of conduct. INCOTERMS 2013; Packing requirements (i.e. regulatory, preservation of cargo types of containers, packing materials, etc.

Unit V Fright Structure in International Trade

Freight Structure and Role of intermediaries: Principles of Freight Rates, Linear Freight Structure, Tramp Freight Structure, Ocean Freight- Types of Sea Freight, Calculation. Air Cargo Tariff Structure- Air Freight Classification, Air Freight Calculation, Factors Affecting Air Freight Rates, Air Freight Consolidation of Cargo Tariff Structure; Shipping Agents, Freight Brokers, Freight Forwarders Stevedores.

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Text Books:

1. Krishnaveni Muthaiah, "Logistics Management and World Sea borne trade", 1st edition, Himalaya Publishing House, 2018.
2. Kent N. Gourdin, "Global Logistics Management, a competitive Advantage for the 21st Century", 2nd edition, Blackwell Publishing, 2006.
3. Khurana P.K., Export management, 12th edition, Cyber Tech Publication, 2019.
4. Cherunilam F., International Trade and Export Management, 21st edition, Himalaya Publication, 2019.

Suggested Readings:

1. Donald J. Bowerson, "Logistic and Supply Chain Management" 5th edition, Prentice Hall of India, 2009.
2. Paul Murphy, Donald Wood, "Contemporary Logistics", 12th edition, Prentice Hall, 2017.
3. Sudalaimutu, S and Anthony Raj, "Logistics Management for International Business" 1st edition, PHI learning, 2009.
4. Rama Gopal C, "Export Import Procedures-Documentation and Logistics" 1st edition, NewAge Publications, 2019.
5. Pierre David, "International Logistics", 5th edition, Cicero Press, 2017.
6. Jhon Mangan and Chandra C.Lalwani, "Global Logistics and Supply Chain Management", 3rd edition, 2016.

SCHOOL OF MANAGEMENT STUDIES CBIT Hyderabad

OPEN ELECTIVE

20MBO101

BUSINESS ENVIRONMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To familiarize the Students with various aspects of Business Environment factors along with detailed discussion on Planning and Industrial policies, mechanism of Fiscal Policy and Monetary Policy.
2. To provide in depth knowledge on changes in the growth of National Income, Inflation, Poverty and other economic policies.
3. To understand the Concept of WTO Agreements and its Implications, EXIM Policies, FEMA on various MNCs activities.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Understand the various environmental factors that influence the domestic and international business activities.
2. Evaluate and Implement appropriate decisions with the help of industrial policy and regulation.
3. Analyze the Fiscal policy and Monetary Policy and its impact on business operations.
4. Analyze the changes in various economic growth factors that have impact on business activities.
5. Adapt trade, EXIM policies and FEMA Act for organization stability and sustainability.

Unit-I Introduction

Colonialism and development of the Indian Economy - Digital Economy : Business Environment - Meaning, Importance, Environmental Factors, Planning in India-Planning Commission- NITI Aayog - Liberalization and Planning, Industrial Policy and Regulatory Structure - Industrial Policy - Industrial Licensing Policy, Made in India.

Unit-II Economic Development

Five Year Planning- Industrial Policy 1991, New Industrial Policy, Startups, MSME, Small Scale Industries (SSI) - Industrial Finance - Foreign Direct Investment (FDI) - Modes - India's Inflow and Outflow.

Unit-III Economic Policies

Fiscal Policy- Latest Union Budget - Reforms Undertaken - Role of Government. Monetary Policy - Basic Concepts, Monetary Policy in the 21st Century - Banking Sector Reforms. Role of Regulatory Institutions in Indian Financial system - RBI and SEBI, Capital Market Institutions - Stock Indices- Derivatives Market - Global and Indian Scenario.

Unit-IV Economic Growth

National Income - Concepts, Foreign Trade and Balance of Payment, Poverty in India, Unemployment in India, Inflation, Human Development Index, Rural Development - Schemes, Problems of Economic Growth.

Unit-V Domestic and International Trade Policy

Evolution of International Financial System, Global Recession and Developing Economies: Policy Changes and Issues - Sector wise Trade Policies: Recent Developments GATT - WTO - Agreements and Implications. EXIM Policies and FEMA: India's New EXIM Policy - Legal Framework - Initiatives, FEMA - Indian Multinational Companies - Role in World Economy.

Text Books:

1. Justin Paul "Business Environment: Text & Cases" , 4th edition, Tata Mcgraw Hill, 2018.
2. V.K Puri and S.K Misra " Indian Economy", 37th edition, Himalaya Publishing house, 2019.
3. Francis Cherunilam "Business Environment: Text & Cases", 25th edition, Himalaya Publication, 2017.
4. Ramesh Singh, "Indian Economy" 11th edition, McGraw Hill Education, 2019.

Suggested Readings:

1. Gaurav Datt and Ashwani Mahajan, "Indian Economy", 72nd ed, S.Chand, 2016.
2. K.Ashwathappa "Essentials of Business Environment: Text, Cases& Exercises" 12th edition, Himalaya Publications, 2014.
3. B N Ghosh, "Business Environment", 1st edition, Oxford University Press, 2014.
4. Pailwar V.K, "Business Environment", 1st edition, PHI learning, 2014.
5. Saleem SK, "Business Environment", 3rd edition, Pearson Education, 2015.
6. Amory Lovins, L. Hunter Lovins, Paul Hawken, Forest Reinhardt, Robert Shapiro, Joan Magretta Harward business review on Business Environment, Harvard business school press, 2000.

20MBO102

CORPORATE SOCIAL RESPONSIBILITY

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of this Course are to:

1. Understand the prominence of Historical evidence in exploring the Concept of CSR and Corporate Governance.
2. Understand the various Forms, Models and Theories of CSR and the role of the major Institutions in promoting CSR.
3. Provide insights into the various indices of CSR and the growth of CSR in various countries.

Course Outcomes: After Completion of the Course, Students will be able to:

1. To describe the basic terms and concepts related to CSR and Corporate Governance.
2. To apply the models and theories to suggest the organizations the essential CSR initiatives.
3. To examine the potential public responsibilities of corporations within the global community.
4. To observe the extent to which Business can meet the Challenges of Sustainable Development.
5. To evaluate how CSR is being practiced in various Organisations.

UNIT-I Introduction

Concept of CSR, Corporate Philanthropy, Corporate Citizenship, Evolution and Development of CSR, CSR Strategy, Arguments in Favour and Against CSR, Drivers of CSR, Dimensions and Importance of CSR, Corporate Governance and Corporate Social Responsibility.

UNIT-II CSR Models and Theories

Forms of CSR - Economic Responsibility, Legal Responsibility, Ethical Responsibility, Philanthropic Responsibility. Models of CSR - Philanthropic model, Ethical model, Statist model, Liberal model, Stakeholder model. Theories of CSR - Fiduciary Capitalism Theory, Stakeholder Theory, Social Contract Theory, Feminist Theory.

UNIT-III CSR Framework

Role of various Institutions in CSR – Role of Government, Educational Institutions, Media. Creating CSR Framework, Framework for rating CSR, International framework for Corporate Social Responsibility. CSR Legislation in India and the World.

UNIT-IV CSR and Development

Business and Inclusive growth, Standards and Indices for CSR, Sustainability and its Challenges, Strategies Business tool for Sustainable Development, Global CSR- CSR and development in Developing countries, CSR practice in India: A study with a Global contrast. Ethical Management and CSR.

UNIT-V CSR Trends and Opportunities

Current trends and opportunities in CSR, Environment Protection and CSR, CSR Case Studies with reference to India - Failures and Success, Future for CSR, Contemporary Issues in CSR.

Text Books:

1. Madhumita Chatterji, "Corporate Social Responsibility", Oxford University Press, 2015.
2. S.S.Khanka, "Business Ethics and Corporate Social Responsibility", S.Chand, 2014.
3. William B, Werther, "Strategic Corporate Social Responsibility: Stakeholders in a Global Environment", Sage publications, 2008.
4. Andrew Crane, Dirk Matten, Laura Spence, "Corporate Social Responsibility: Readings and Cases in a Global Context", 2007.

Suggested Readings:

1. Subhasis Ray, S. Siva Raju, "Implementing Corporate Social Responsibility: Indian Perspectives", 2014.
2. K.S. Ravichandran, Corporate Social Responsibility – Emerging Opportunities and Challenges in India", 2013.
3. Robert A.G. Monks, Nell Minow, "Corporate Governance", 5th edition, Wiley, 2013.
4. Bob Tricker, "Corporate Governance- Principles, Policies, and Practices", Oxford University Press, 3rd edition, 2018.
5. C. V. Baxi, Ajit Prasad, "Corporate Social Responsibility: Concepts and Cases: the Indian Experience", Excel Books India.
6. Subash Chandra Das, "Corporate Governance in India", 4th edition, PHI Learning

SCHOOL OF MANAGEMENT STUDIES
CBIT

20MBO103

BUSINESS LAW AND ETHICS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of this Course are:

1. To give an Overview of Legal issues that they deal within their Professional and Personal life and to provide knowledge on General Contracts, Special Contracts and Negotiable Instruments.
2. To discuss the formation of Company, Process, and Dissolution and to educate on the rights of consumers and Redressal mechanism.
3. To provide understanding the significance of Ethical conduct for Business and Community.

Course Outcomes: After Completion of the Course, the Students will be able to:

1. Apply Legal aspects of Business law to the problems associated with business and its transactions
2. Critically review the special contracts and reflect them on the current Legal issues
3. Understand various provisions of Companies Act.
4. Claim the rights as a consumer by recalling the Redressal Mechanism available
5. Exhibit the skills required to identify and resolve the ethical issues in the Business environment.

Unit- I Introduction

Definition, Contract and Agreement, Essential Elements of a Valid Contract, Classification of Contracts. Offer and Acceptance - Legal Rules, Communication of Offer, Acceptance and Revocation. Consideration - Need, Legal Rules, Stranger to a Contract, Contract without Consideration. Capacity to Contract. Free consent - Coercion, Undue Influence, Misrepresentation, Fraud, Mistake. Performance of Contract. Remedies for Breach of Contract - Quasi Contracts - Kinds, Quantum Meruit.

Unit – II Special Contracts

Special Contracts: Indemnity and Guarantee - Contract of Indemnity, Contract of Guarantee, Distinction between Contract of Indemnity and Guarantee, Bailment and Pledge - Classification of Bailment, Duties and Rights of Bailor and Bailee, Termination of Bailment, Pledge, Bailment vs. Pledge, Rights and Duties of Pawnee and Pawnor, Pledge by Non-Owners. Contract of Agency - Creation of Agency, Classification of Agents, Relations of Principal and Agent, Principal with Third Party, Delegation of Authority, Termination of Agency. Sale of Goods Act - Distinction between Sale and Agreement to Sell. Conditions and Warranties-Express and Implied, Caveat Emptor. Negotiable Instruments Act: Characteristics, Types, Essential elements and distinctions between Promissory Note, Bill of Exchange, and Cheques - Types of Crossing.

Unit-III Companies Act

Definition of Company - Characteristics - Classification of Companies - Formation of Company - Memorandum and Articles of Association - Prospectus - Shareholders Meetings - Board Meetings - Law relating to Meetings and Proceedings - Company Management - Qualifications, Appointment, Powers, and Legal position of Directors - Board - M.D and Chairman - their powers, Prevention of Oppression and Mismanagement, Winding-up of a Company.

Unit-IV Consumer Protection Act

Consumer Protection Law: Introduction to Consumer Protection Law in India, Rights of Consumers, Consumer Councils - Central and State Councils, Redressal Machinery - National Commission, State Commission, District Forum.

Unit-V Business Ethics

Ethical and Value Based Considerations – Need and Justification – Business Ethics and Efficiency – Social Responsibility of Business – Fair and Just cooperation among Owners, Managers, Workers and Customers –

Fair Market Wages – Integrity and Ethical consideration in Business Operations – Indian Value system and its relevance in Management.

Text Books:

1. N.D. Kapoor, "Elements of Mercantile Law", Sultan Chand & Co., 2018.
2. K.R. Bulchandani, "Business Law for Management", 6th ed, HPH, 2014.
3. Satish B. Mathur, "Business Law", Tata Mc Graw Hill, 2010.
4. O. C. Ferrell et.al., "Business Ethics: Ethical Decision Making and Cases", Cengage Learning, 2014

Suggested Readings:

1. PPS Gogna, "A Text Book of Company Law", 6th ed., S. Chand, 2014.
2. Akhileshwar Pathak, "Legal Aspects of Business", 6th ed., Tata McGraw Hill. 2014.
3. Kenneth W. Clarkson, Roger LeRoy Miller & Frank B. Cross , "Business Law: Text and Cases", Cengage Learning, 2017.
4. Henry R. Cheeseman, "Business Law", Pearson, 2018
5. Christine Ladwig & George Siedel, "Strategy, Law and Ethics for Business Decision, West Academic Publishing, 2020
6. Richard T De George, Business ethics, 7th ed., Pearson, 2014.

SCHOOL OF MANAGEMENT STUDIES CBIT Hyderabad

20MBO202

BANKING MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To provide Conceptual and Practical understanding of Banking Industry and Monetary Policy implications.
2. To make Students proficient in Management of various Lending functions and educate them in Credit Delivery and Monitoring and Managing.
3. To equip the Students with latest trends, Regulations and Innovations in Banking arena.

Course Outcomes: After Completion of the Course, Student will be able to:

1. Understand Banking system and get insight on overview of Banking.
2. Acquire Knowledge on Banks monetary Policy –Implication and Analyze Financial Statements.
3. Develop a clear understanding and knowledge about the Lending functioning of bank.
4. Analyse the importance of Credit Delivery and monitoring as well as how a bank manages Credit Risk.
5. Explain on banking Regulatory system and Evaluate new innovations in banking products and services.

Unit -I Introduction

Banking: Evolution of Banking in India - Origin, Nationalization, Reforms of Banking sector. Types of Banking: Universal Banking, Wholesale Banking, Private Banking, Retail Banking; Role of Banks in the development of Economy, RBI: Origin and Growth - Functions. Monetary Policy: Central Bank tools to regulate Money Supply- Policy rates, Monetary Ratios, Application of Monetary policy tools in India. Banks Financial statements: Basic Concepts - Bank Liabilities, Assets and Income statement. Analysing Banks Financial Statements, CAMELS, Ratings, Key Performance indicators.

Unit -II Sources and Uses of Bank Funds

Sources of Bank Funds, Deposits, Deposit Insurance in India, Pricing, Deposit Services, Need, Approaches to Deposit Pricing, Bank Liabilities - Non Deposit sources. Features of Bank Credit, Types of lending, Steps in assessment of Credit Worthiness of a Prospective borrower, Credit process and Financial appraisal for Credit Decisions, Different types of Loans and their features, Loan Pricing- The Basic Model, Pricing Fixed and Floating Rate Loans, Hedging, Matched funding, and Price leadership model, Cost-Benefit Loan Pricing, Customer Profitability Analysis.

Unit - III Credit Delivery and Monitoring

Modes of Credit Delivery - Cash Credit, Working Capital Demand Loan, Overdrafts, Bills finance and Pricing of Loans. Legal aspects of Lending - Secured and Unsecured Loans and Types of Securities. Credit Monitoring-Need for Credit Review, Triggers of Financial Distress - Models of Financial Distress - The Altman's Z score and other Models. Rehabilitation Process.

Unit - IV Managing Credit Risk

Basic Concepts - Expected and Unexpected Loss, Elements of Credit Risk, Credit Risk of Portfolio. Credit Risk Models - Basic Model and Modelling Credit Risk. Managing Credit Risk-Estimating PD, EAD and LGD, Need for the Credit Risk Models - Best Practice Industry Model Credit Migration Approaches- Credit Migration Approach used by Credit Metrics, Calculation of Portfolio Risk and Credit Migration Approach Used by Credit Portfolio View. Option pricing Approach - KMV Model.

Unit -V Regulation and Innovations in Banking System

Regulation of Bank Capital: Need to regulate, Concept of Economic Capital, Regulatory Capital, Basel Accords I, II and III - Implementation, Criticism. NPA's - Gross and Net concept of NPA's, Causes, Implications and Recovery of NPA's. Banking Innovations: Need, Core Banking solutions, Retail Banking - Products and Services - Nature, Scope, Future and Strategies, Plastic Money and E-Money, National Electronic Funds Transfer, RTGS, ATM, Mobile Phone Banking, Net Banking and Security Issues in E-Banking. Cyber Security and Frauds. Mergers and Acquisitions in Banks.

Text Books:

1. Padmalatha Suresh & Justin Paul, "Management of Banking & Financial Services", 3rd Edition., Pearson Education, 2016
2. Peter.S.Rose & Sylvia. C. Hudgins, "Bank Management & Financial Services', 8th Edition, Tata McGraw Hill, 2014.
3. K. Sriharsha Reddy & R.Nageswar Rao, "Banking & Insurance, First Edition, Paramount Publishing House, 2013.
4. Vasant Desai, "Banks & Institutional Management", 2nd Edition, Himalaya Publishing House, 2010.

Suggested Readings:

1. Bank Financial Management, IIBF, Macmillan 2010.
2. Vijayaragavan Iyengar, Introduction to Banking, Excel Books, 2009.
3. Reddy.P.N., Appannaiah.H.R.; Theory & Practice of Banking;8th Edition Himalaya Publishing House. 2004.
4. V.Rajaraman , Credit Appraisal Risk Analysis & Decision Making, 10th Edition, snow White (2019).
5. S.K. Maheshwari S.N. Maheshwari, "Banking Law and Practice", 11th Edition, Kalyani Publishers 2014.
6. Mittal R.K., Saini A.K. & Dhingra Sanjay, "Emerging Trends in the Banking Sector", Macmillan 2008.

20MBO203

CUSTOMER RELATIONSHIP MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of this Course are:

1. To make students understand the Concepts and Principles of CRM and its dynamism.
2. To educate Students on the Strategic, Operational and Analytical Customer Relationship Management.
3. To enable Students to understand how to manage Customer Relationship.

Course Outcomes: After Completion of the Course, the Students will be able to:

1. Understand and Analyze the Relationship theory from the perspective of the Customer and the Organization.
2. Develop and evaluate Strategic CRM decisions.
3. Analyze and Devise Operational CRM Decisions.
4. Appraise Analytical CRM Decisions.
5. Evaluate CRM Implementation Strategies.

Unit-I Introduction

Definition, CRM Constituencies, Commercial and not-for-profit contexts of CRM, Models of CRM, Understanding Relationships – Relationship, Relationship quality, Relationships with Customers and Suppliers, Customer Lifetime value, Customers Satisfaction, Loyalty and Business Performance, Relationship Management Theories, Managing the Customer Lifecycle - Customer Acquisition, Managing the Customer Lifecycle- Customer Retention and Development.

Unit-II Strategic CRM

Customer Portfolio Management (CPM) - Portfolio, Customer, Basic Disciplines of CPM, CRM in the Business-to-Business context, Customer Portfolio Models, Additional Customer Portfolio Management Tools, Strategically significant Customers, Seven Core Customer Management Strategies. Delivering Customer Experienced Value - Understanding Value, Customers Experience Value, Modelling Customer - Perceived Value, Sources of Customer Value, Customization, Value through Marketing Mix. Managing Customer Experience - Concepts, Customer Experience Management vs. Customer Relationship Management.

Unit-III Operational CRM

Sales Force Automation (SFA) - Meaning, SFA eco-system, SFA adoption, SFA and Sales Performance Marketing Automation - Benefits. Service Automation - Customer Service, Modelling Service Quality, Customer Service Excellence certification, Service Automation, benefits from Service Automation.

Unit-IV Analytical CRM

Developing and Managing Customer related databases - Corporate Customer - Related data, Structured and Unstructured Data, Customer - Related Database, Data Integration, Data Warehousing, Data Marts, Knowledge Management. Using Customer - Related Data - Analytics for CRM Strategy and Tactics, Analytics throughout the Customer Lifecycle, Analytics for Structured and Unstructured data, Big Data Analytics, Analytics for Structured Data.

Unit-V CRM Implementation

Develop the CRM Strategy, Build CRM Project foundations, Needs Specification and Partner selection, Project Implementation, Performance Evaluation.

Text Books:

1. Francis Buttle and StanMaklan,"CRM:Concepts and Technologies", 3rd Ed., Routledge, 2015.
2. Alok Kumar Rai, "Customer Relationship Management: Concepts and Cases", 2nd Ed., PHI, 2013.
3. Jagdish N. Sheth, Atul Parvatiyar and G.Shainesh, "Customer Relationship Management", "Emerging Concepts, Tools and Application",1st Ed.,Tata McGraw Hill, 2001.
4. Dilip Soman and Sara N-Marandi, "Managing Customer Value: One StageataTime"1stEdition, World Scientific Publishing, 2009.

Suggested Readings:

1. Ken Burnett, "The Handbook of Key Customer Relationship Management", Pearson Education, 2005.
2. Jill Dyche, "The CRM Handbook: A Business Guide to Customer Relationship Management", Addison Wesley, 2001.
3. Zikmund, William G., Mcleod, Raymond, Jr., Gilbert, Faye. W., "Customer Relationship Management: Integrating Marketing Strategy and Information Technology", John Wiley & Sons, 2003.
4. Greenbag, Paul., "CRM at the Speed of Light, Fourth Edition: Social CRM 2.0 Strategies, Tools, and Techniques for Engaging Your Customers", 4th Edition, McGraw-Hill Education, 2008.
5. Baran, R and Galka, R., CRM: The Foundation of Contemporary Marketing Strategy", 1st Edition, Routledge, 2013.
6. Mukesh Chaturvedi, AbinavChaturvedi, "Customer Relationship Management - An Indian Perspective", 2nd Edition, Excel Books, 2008

20MBE303

PERFORMANCE AND COMPENSATION MANAGEMENT

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits	4

Course Objectives: The Objectives of the Course are:

1. To develop an understanding of the concept of Performance Management and the importance of the various Performance Assessment techniques.
2. To discuss the importance of Performance Metrics and benchmarking in improving Individual and Organizational Performance.
3. To understand the Concept of Compensation Management and its importance in Employee Retention.
4. To introduce various methods of designing Compensation System and make Students aware about the Management of Employee Benefits.

Course Outcomes: After Completion of the Course, Students will be able to:

1. Effectively design the process of Performance Management system.
2. Efficiently identify an appropriate Performance Appraisal method at their workplace as an HR Professional.
3. Decide the standard performance benchmarks to influence the Performance of Organizational members.
4. Influence the Stakeholders of Compensation and also integrate compensation with other HR initiatives in line with Organizational realities.
5. Formulate new set of Compensation system and manage the various Employee Benefits in the Organisations.

Unit-I Introduction

Definition, Performance Appraisal to Performance management. Objectives of Performance Management. Process of Performance Management. Performance planning and Role clarity. KPAs - Performance Targets. Trait, Behaviour and Results approaches to measuring Performance. The impact of HRM practices on Performance.

Unit-II Performance Management Systems

Assessment Centre - Psychometric tests: Aptitude or Ability tests and Personality Tests. Role Play- Self-appraisal - 360 Degree appraisals- Rating-less appraisals for the future of Performance Management System (PMS). Critical incidents methods. Attribution theory- Causal matrix. Alternative models for Assessing Performance.

Unit-III Performance Bench marking

Diagnosis and Performance improvement - Performance Measures Pyramid - Direction of trouble shooting with Behavior model- Mager and Pipes trouble shooting model- European Foundation for Quality Management (EFQM) Excellence model- Diagnostic and Process bench marking. Outcome Metrics- Economic Value Added (EVA). Building a High Performance culture-Ethics in Performance Management.

Unit-IV Strategic Compensation Management Concepts

Concept of Compensation- Exploring and defining the Compensation- Job Evaluation approach to Compensation- Compensation dimensions- Role of Compensation in Organization- factors influencing Compensation- Aligning Compensation Strategy with HR Strategy and Business Strategy- New trends in Compensation Management.

Unit-V Designing Compensation System - Employee Benefits Management

Traditional Pay System and Modern Pay Systems- Pay for Performance, Competency Based Pay, Equity Based Rewards, Team Rewards- Reward Strategy and Psychological Contract- Law relating to Compensation- International Compensation- Executive Compensation, Benefits Administration, Employee Welfare and Working conditions- Statutory and Voluntary measures.

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Text Books:

1. Michael Armstrong, Armstrong's Handbook of Performance Management: An Evidence-Based Guide to Delivering High Performance, kogan Page, 2012
2. Bhattacharyya, Performance Management Systems and Strategies, Pearson, 2011
3. Joseph J. Martocchio, Strategic Compensation: A Human Resource Management Approach, Pearson Ed, 2018
4. Henderson, Compensation Management in a Knowledge Based World, Pearson Ed, 2007

Suggested Readings:

1. A S Kohli, T Deb, Performance Management, Oxford Higher Education, 2008
2. A.M. Sharma, Performance Management systems, HPH, 2010
3. Clive Fletcher & Richard Williams, Appraisal: Improving Performance and Developing the Individual, Routledge, 2016.
4. T V Rao, Performance Management: Toward Organizational Excellence, Sage Publications Pvt. Ltd, 2016.
5. George Milkovich, Compensation, McGraw-Hill Higher Education, 2019.
6. Tapomoy Deb, Compensation Management: Text & Cases, Excel Books, 2012.

20MBSD201

PERSONALITY DEVELOPMENT AND CAREER GUIDANCE

Instruction	4 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	2

Course Objectives: The Objectives of the course are:

1. To educate the students on the concepts and aspects of Personality Development.
2. To help them understand the important elements in Soft Skills.
3. To prepare them for facing job Interviews and Career Planning.

Course outcomes: After completion of the course, students will be able to:

1. Identify their personality style, while recalling the importance of Personality Development for better employment and entrepreneurship
2. Develop right attitude and exhibit appropriate leadership style to achieve self and Organizational goals.
3. Demonstrate the soft skills that are required for effective functioning of an Organization
4. Exhibit good employability skills that are expected from the Industry.
5. Devise and Implement a Proper Career Planning and development Strategy.

Unit-I Introduction

The Concept of Personality- Dimensions and Theories of Freud and Erickson- Personality Analysis- Significance of Personality Development- Personality Tests.

Unit-II Aspects of Personality Development

Attitude- Concept- Significance- Ways to Develop the Attitude. Self-awareness- Meaning, Components, benefits, improving Self-awareness. Goal Setting- Meaning, Importance, Types, Steps for Goal Setting, SMART Goals. Leadership Development- Importance, Styles, Theories of Leadership.

Unit-III Soft Skills

Interpersonal Skills- Time Management- Networking- Creative Thinking- Problem Solving-Negotiation and Conflict Resolution- Stress Management- Work Ethics

Unit-IV Job Preparation and Career Skills

Sources of Occupation Information- Resume Building- Writing Resumes and Cover Letters - The Art of Participation in Group Discussions- Psychometric Analysis- Strategies to be Successful in an Interview- Mock Sessions.

Unit-V Career Planning and Development

Career Opportunities - Career Goals and Plans- Benefits of Career Planning- Guidelines for Choosing a Career- Tips for Successful Career Planning- Developing Career Goals- Career Growth Benefits from E-Learning- Career Planning within a Corporate Setting and while Switching a Company (Things to know while starting a Career)

SCHOOL OF MANAGEMENT STUDIES CBIT Hyderabad

Text Books:

1. BarunK.Mitra, " Personality Development and Soft Skills", 2nd Edition, Oxford University Press, , 2016.
2. Swamy Vivekananda, "Personality Development", Adhakshya Advaita Ashrama, 1st Edition, 2015.
3. M.S. Rao, "Soft Skills: Enhancing Employability, Connecting campus With Corporate", Wiley (Dreamtech Press), 1st Edition, 2019.
4. Mellisa Hume, "Career Guidance for Now and for the Future", Balboa Press, 1st Edition, 2014.

Suggested Readings:

1. Niles, S. & Harris-Bowlsbey, J. Career development interventions in the 21st century. (4th ed.), Upper Saddle River, NJ: Pearson, 2013.
2. Bill Gothard, Phil Mignot, Melvyn Ruff, Career Guidance in context, Sage Publications, 2012.
3. Richard N. Bolles, What Color Is Your Parachute? 2020 APractical Manual for Job-Hunters and Career Changers, Ten Speed Press, 2019
4. Gibson, R. & Mitchell, M. "Introduction to Career Counselling for the 21st Century", Pearson Education, 2005.
5. Joseph Murphy, "The Power of Your Subconscious Mind", Jaico Publishing House, 1st Edition, 2018.
6. Stephen R. Covey "The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change", 25th Edition, Turtleback books, 2013.

20MT C05

CALCULUS

(Common to ECE, EEE, MECH, CHEM, CIVIL)

Instruction	3 L+1T/2P Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives:

1. To explain the solutions of system of linear equations by Matrix Methods.
2. To discuss mean value theorems.
3. To explain the Partial Derivatives and the extreme values of functions of two variables.
4. To discuss the convergence and divergence of the series.
5. To explain the expansion of functions in sine and cosine series.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the Matrix Methods to solve system of linear equations.
2. Analyse the geometrical interpretation of Mean value theorems.
3. Determine the extreme values of functions of two variables.
4. Examine the convergence and divergence of infinite Series.
5. Calculate the Euler's coefficients for Fourier series of a function.

UNIT-I

Matrices: Rank of a matrix, Echelon form, consistency of linear system of equations, Linear dependence and independence of vectors. Eigen values, Eigenvectors, Properties of Eigen values& Eigen vectors, Cayley-Hamilton theorem, Quadratic form, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-II

Calculus: Rolle's Theorem, Lagrange's Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, Radius of curvature, Centre of curvature, Evolute and Involute.

UNIT-III

Multivariable Calculus (Differentiation): Functions of two variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions , Change of variables, Jacobians, Taylor's theorem for functions of two variables, Maxima and minima of functions of two variables.

UNIT-IV

Sequences and Series: Convergence of sequence and series. Tests for convergence of series: Comparison test, limit comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, alternating series, Leibnitz's series, absolute and conditional convergence.

UNIT-V

Fourier series: Periodic functions, Euler' formulae**,** Conditions for a Fourier expansion, functions having points of discontinuity, change of interval, even and odd functions, half range sine series, half range cosine series, and its applications in practical Harmonic analysis.

I/c HEAD
Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. B.V.Ramana., Higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint,

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw- Hill, New Delhi, 2008.
2. R.K.Jain, S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. David.Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

I/c HEAD
Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

20CY C01 **CHEMISTRY**

(Common to all branches)

Instruction:	3Hours per Week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	3

Course Objectives

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

Course Outcomes

At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

UNIT-I Atomic and molecular structure and Chemical Kinetics:

Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2 , He_2^+ ,N_2 , O_2 , O_2^- , CO, NO). Pi- molecular orbitals of benzene and its aromaticity.

Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction-Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity).Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, – Reference electrodes (NHE, SCE)- electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations.Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.

Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel cell.

HEAD
Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad–75.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism -

Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid) & Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.

Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)

Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)

Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides)

Cyclization (Diels - Alder reaction)

UNIT–IV Water Chemistry:

Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process),ion exchange method and Reverse Osmosis.Specifications of potable water & industrial water.Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V Engineering Materials and Drugs:

Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber).Conducting polymers- Definition, classification and applications.

Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography.

Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol-gel method.Carbon nanotubes and their applications.Characterisation of nanomaterials by SEM and TEM (only Principle).

Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd.,New Delhi,16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition(2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla,Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Readings:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

20CE C01

ENGINEERING MECHANICS - I

Instruction:	3 L Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	3

Course Outcomes: At the end of the course the student will be able to

1. Calculate the components and resultant of coplanar forces system.
2. Understand free body diagram and apply equilibrium equations to solve for unknown forces.
3. Apply concepts of friction for solving engineering problems.
4. Analyse simple trusses for forces in various members of a truss.
5. Determine centroid for elementary, composite figures and bodies.

UNIT- I:

Resolution and Resultant of Force System: Basic concepts of a force system. Components of forces in a plane. Resultant of coplanar concurrent force system. Moment of a force, couple and their applications. Resultant of coplanar non-concurrent force system.

UNIT - II:

Equilibrium of Force System: Free body diagram, equations of equilibrium. Lami's theorem, equilibrium of coplanar force systems.

UNIT - III:

Friction: Theory of static friction, Laws of friction, applications to single body, connected systems, wedge friction and belt friction.

UNIT - IV:

Analysis of Simple Trusses: Introduction to trusses, analysis of simple trusses using method of joints and method of sections.

UNIT - V:

Centroid and Centre of Gravity:

Centroid of lines and areas from first principles, centroid of composite figures, theorems of Pappus, centre of gravity of bodies and composite bodies.

Text Books:

1. K. Vijaya Kumar Reddy and J. Suresh Kumar, "*Singer's Engineering Mechanics: Statics and Dynamics*", B. S. Publications (SI Units), 3rd edn. Rpt., 2019.
2. A. Nelson., "*Engineering Mechanics*", Tata McGraw Hill, Delhi, 2010.

Suggested Reading:

1. Irving H. Shames, *"Engineering Mechanics",* 4th Edition, Prentice Hall, 2006.
2. R. C. Hibbeler, *"Engineering Mechanics: Principles of Statics and Dynamics",* Pearson Press, 2006.
3. Basudeb Bhattacharyya, "*Engineering Mechanics*", Oxford University Press, 2nd edn., 2016.

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20CS C01

PROGRAMMING FOR PROBLEM SOLVING
(Common to all Programs)

Instruction	3 Periods per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
4. Develop in tuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and understand the computing environments for scientific and mathematical problems.
2. Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
3. Choose data types and control structures to solve mathematical and scientific problem.
4. Decompose a problem into modules and use functions to implement the modules.
5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high-level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence, and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping, and nested statements.

Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes, Case study using functions and control statements.

UNIT – III

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting (Selection and Bubble) algorithms, 2-D arrays, matrix operations.

Strings: Introduction, strings representation, string operations with examples. Case study using arrays.

UNIT – IV

Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, dynamic memory allocation, advantages, and drawbacks of pointers.

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions, and enumerated data types.

UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handling during file operations.

Preprocessor Directives: Types of preprocessor directives, examples.

Text Books:

1. M.T. Somashekar "Problem Solving with C", 2nd Edition, Prentice Hall India Learning Private Limited 2018
2. AK Sharma, "Computer Fundamentals and Programming", 2nd Edition, University Press, 2018
3. Pradeep Deyand Manas Ghosh, "Programming in C", Oxford Press, 2nd Edition, 2017

Suggested Reading:

1. Byron Gottfried, Schaum's Outline of Programming with C", Mc Graw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Reema Tharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm.
2. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

20CY C02

CHEMISTRY LAB

Instruction:	4 Hours per Week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	2

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theoretical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes

At the end of the course student will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

Chemistry Lab

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2}& Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2}Potentiometrically using $KMnO_4$ solution
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

Text Books:

1. J. Mendham and Thomas , "Vogel's text book of quantitative chemical analysis", Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg & A.Gulati,; R. Chand & Co. : New Delhi (2011).

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Suggested Readings:

1. Dr.Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

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20CS C02

PROGRAMMING FOR PROBLEM SOLVING LAB
(Common to All Programs)

Instruction	4 Periods per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50 Marks
Credits	2

Course Objectives: The objectives of this course are

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and setup program development environment.
2. Design and test programs to solve mathematical and scientific problems.
3. Identify and rectify the syntax errors and debug program for semantic errors
4. Implement modular programs using functions.
5. Represent data in arrays, pointers, structures and manipulate them through a program.
6. Create, read, and write to and from simple text files.

Lab experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

Text Books:

1. Pradeep Dey and Manas Ghosh, "Programming in C", Oxford Press, 2^{nd} Edition, 2017.
2. Reema Tharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

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20ME C02

WORKSHOP / MANUFACTURING PRACTICE

Instruction	5P Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2.5

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive &team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes: At the end of the course, the students are able to

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
3. Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
4. Perform various operations in welding, machining and casting processes.
5. Conceptualize and produce simple device/mechanism of their choice.

List of Exercises

CYCLE 1

Exercises in Carpentry

1. To plane the given wooden piece to required size
2. To make a lap joint on the given wooden piece according to the given dimensions.
3. To make a dove tail-joint on the given wooden piece according to the given dimensions.

Exercises in Tin Smithy

1. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
2. To make a scoop.
3. To make a pamphlet box.

Exercises in Fitting

1. To make a perfect rectangular MS flat and to do parallel cuts using Hacksaw
2. To make male and female fitting using MSflats-Assembly1
3. To make male and female fitting using MSflats-Assembly2

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Exercises in House Wiring

1. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch, and wiring of one buzzer controlled by a bellpush
2. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket
3. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- way switches.

CYCLE 2

Exercises in Casting

1. Study of Sand casting process and its applications.
2. Green sand moulding practice for a single piece pattern
3. Green sand moulding practice for a split pattern with a horizontal core

Exercises in Welding

1. Study of gas welding equipment and process. Identification of flames, making of Butt joint with gas welding.
2. Study of Arc welding process, making Butt joint with DCSP,DCRP
3. Study of Arc welding process, making Lap joint with A.C

Exercises in Machine shop

1. Study of Machine Tools like Lathe, Drilling, Milling and Shaper.
2. Facing, Plain turning and Step turning operations on Lathe machine.
3. Knurling and Taper turning on Lathe machine

Open ended Exercise:

1. Student should produce a component /mechanism by applying the knowledge of any one trade or combination of trades.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I, 2008 and Vol. II, 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I", Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

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20ME C03 **ENGINEERING EXPLORATION**

Instruction	4 Hours per week
Duration of SEE	Nil
SEE	Nil
CIE	50 Marks
Credits	1.5

Prerequisites: Nil

Course Outcomes: At the end of the course, the students are able to

1. Understand the role of an engineer as a problem solver.
2. Identify multi-disciplinary approaches in solving an engineering problem.
3. Build simple systems using engineering design process.
4. Analyze engineering solutions from ethical and sustainability perspectives.
5. Use basics of engineering project management skills in doing projects.

UNIT- I

Role of Engineers: Introduction, science, engineering, technology, engineer, scientist, role of engineer, various disciplines of engineering, misconception of engineering, expectations for the 21st century engineer and NBA graduate attributes.

Engineering problems and Design: Multidisciplinary facet of design, pair wise comparison chart, introduction to econometrics system, generation of multiple solution, Pugh chart, motor and battery sizing concepts, introduction to PCB design.

UNIT- II

Mechanisms: Basic components of a mechanism, degrees of freedom or mobility of a mechanism, 4-bar chain, crank rocker mechanism, slider crank mechanism, simple robotic arm building.

Platform-based development: Introduction to programming platforms (Arduino) and its essentials, sensors, transducers and actuators and their interfacing with Arduino.

UNIT- III

Data Acquisition and Analysis: Types of data, descriptive statistics techniques as applicable to different types of data, types of graphs and their applicability, usage of tools (MS-Office /Open Office/ Libre Office / Scilab) for descriptive statistics, data acquisition (temperature and humidity) using sensors interfaced with Arduino, exporting acquired data to spreadsheets, and analysis using representation.

UNIT- IV

Process Management: Introduction to Agile practice, significance of team work, importance of communication in engineering profession, project management tools, checklist, timeline, Gantt chart, significance of documentation.

UNIT -V

Engineering Ethics & Sustainability in Engineering: Identifying Engineering as a profession, significance of professional ethics, code of conduct for engineers, identifying ethical dimensions in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas.

Sustainability in Engineering: Introduction, sustainability leadership, life cycle assessment, carbon foot print.

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Text Books:

1. Clive L. Dym, Patric Little, Elizabeth J Orwin, "Engineering Design: A project-based introduction", 4th edition, Willey.
2. Matthew Python, "Arduino programming for beginners", Independently published,2020.
3. Patrick F. Dunn , "Measurement and data Analysis for engineering and science" , thirdedition,2014.
4. Andrew Stellman, Jennifer Greene, "Head First Agile: A brain-friendly guide to Agile principles, ideas, and real-world practices", Kindle Edition.

Suggested Reading:

1. Charles B. Fleddermann, "Engineering ethics", fourth edition, Prentice Hall,2012.
2. Rob Lawlor, "Engineering in society", second edition, Royal academy of engineering.
3. Richard Dodds, Roger Venables, "Engineering for sustainable development: Guiding principles", The Royal Academy of engineering, 2005.
4. Richard S. Paul, "Robot Manipulators: Mathematics, Programming, and Control", MIT Press.

ENGINEERING EXPLORATION ASSESSMENT SCHEME				
S. No	**Name of the module**	**Work Hours**	**Marks**	**Evaluation**
1	Role of Engineers	4	-	Evaluation - I
2	Engineering Design	16	5	
3	Mechanisms	6	3	
4	Engineering Ethics	2	2	
5	Platform-based Development	16	5	Evaluation - II
6	Data Acquisition and Analysis	6	4	Evaluation-III
7	Project Management	4	4	
8	Sustainability in Engineering	6	2	
9	Course Project Reviews	12	20	Final Evaluation
10	Code of conduct	-	5	
	Total	**72**	**50**	

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20MT C06

VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS

(Common to ECE, EEE, MECH, CHEM, CIVIL)

Instruction	3 L+1T/2P Hours per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives:

1. To explain double and triple integrals of various functions and their significance.
2. To explain Scalar and vector functions with its Physical interpretations.
3. To discuss vector line, surface and volume integrals.
4. To explain relevant methods to solve first order differential equations.
5. To discuss the solution of higher order differential equations.

Course Outcomes:

Upon completing this course, students will be able to:

1. Calculate the areas and volumes.
2. Apply the vector differential operators to Scalars and Vector functions.
3. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
4. Calculate the solutions of first order linear differential equations.
5. Solve higher order linear differential equations.

UNIT-I

Multivariable Calculus (Integration): Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Area enclosed by plane curves, Triple integrals, Volumes of solids.

UNIT-II

Vector Differential Calculus: Scalar and vector point functions, Gradient, Directional derivative, potential function. Divergence, Physical interpretation of Divergence, Curl, Physical interpretation of curl, vector identities.

UNIT-III

Vector Integral Calculus: Line integral, Surface integral and Volume integral, Green's theorem in a plane, Stoke's theorem and Gauss's divergence theorem (without proof**)**.Fluid flow, Physical interpretation of the divergence.

UNIT-IV

First Order Ordinary Differential Equations: Exact differential equations, Equations reducible to exact equations, Linear equations, Bernoulli's equation, Clairaut's equation, Riccati's equation, Orthogonal trajectories, Chemical reactions and solutions, Rate of decay of Radio-active materials.

UNIT-V

Higher Orders Linear Differential Equations: Higher order linear differential equations with constant coefficients, rules for finding Complementary function, Particular Integral and General solution. Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point, regular singular point and Power Series solution. Applications: LR and LCR circuits.

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Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition,2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.

Suggested Reading:

1. N.P.Bali and Dr.Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,9th edition, 2014.
2. R.K.Jain, S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Publications,5th edition, 2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson, Reprint, 2002

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20 EG C01

ENGLISH

(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	2

Course Objectives: This course will introduce the students:

1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

Course Outcomes: After successful completion of the course the students will be able to:

1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques

UNIT-I Understanding Communication in English:
Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.
Vocabulary &Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT-II Developing Writing Skills I:
Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.
Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT-III Developing Writing Skills II:
Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response
Vocabulary and Grammar: Subject-verb agreement.
Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

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UNIT-IV Developing Writing Skills III:
Report writing – Importance, structure, elements of style of formal reports ; Writing a formal report.
Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

UNIT-V Developing Reading Skills:
The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar: Words often confused; Use of standard abbreviations.

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan,2017.
2. Swan Michael, Practical English Usage.OUP.1995.

Suggested Readings:

1. Wood F.T, Remedial English Grammar,Macmillan,2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, Communication Skills. Oxford University Press,2011.

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20PY C07

PHYSICS
(CHEMICAL)

Instruction	3 L / week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:
The objectives of the course is to make the student

1. Learn the basic concepts of wave nature of light
2. Know about the properties of magnetic and dielectric materials
3. Understand the basics of nanomaterials
4. Familiarize with fundamental ideas of quantum mechanics

Course Outcomes: At the end of the course, the student will be able to

1. Demonstrate the physical properties of the light.
2. Find the applications of lasers and optical fibers in engineering and technology.
3. Identify different types of magnetic and dielectric materials.
4. Recall the fundamentals of nanomaterials.
5. Apply the ideas of quantum mechanics for related problems

UNIT-I
Wave Optics: Huygens' principle – Superposition of waves – Interference of light by splitting of wavefront and amplitude – Fresnel's biprism– Interference in thin films (reflected light) – Newton's rings – Fraunhofer diffraction from a single slit – Double slit diffraction–Concept of N-slits–Diffractiongrating and its resolving power. Polarization: Introduction–Malus's law–Double refraction –Nicol's prism–Quarter-wave plate and half-wave plate–Optical activity– Laurent's half shade polarimeter.

UNIT-II
Lasers: Characteristics of lasers – Einstein's coefficients – Amplification of light by population inversion–Rubylaser– He-Nelaser–Semiconductorlaser–Applicationsoflasersinengineeringand medicine. **Fiber Optics:** Introduction –Construction –Principle –Propagation of light through an optical fiber – Numerical aperture and acceptance angle – Step-index and graded-index fibers –Pulse dispersion – Fiber losses –Fiber optic communication system –Applications.

UNIT-III
Dielectric Materials: Introduction – Dielectric polarization – Types of dielectric polarization: electronic & ionic polarizations (quantitative); orientation & space-charge polarizations (qualitative) – Frequency and temperature dependence of dielectric polarization – Determination of dielectric constant (Schering bridge method) –Ferroelectricity– Barium titanate– Applications of ferroelectrics.
Magnetic Materials: Origin of magnetism – Magnetic moment - Bohr magneton – Classification of magnetic materials: dia, para, ferro, anti-ferro and ferrimagnetic materials – Weiss molecular field theory – Domain theory – Hysteresis curve – Soft and hard magnetic materials –Applications.

UNIT-IV
Nanomaterials: Properties of materials at reduced size – Surface to volume ratio – Quantum confinement – Preparation of nanomaterials: bottom-up approach (sol-gel method) and top-down approach (ball milling method) – Elementary ideas of carbon nanotubes – Applications of nanomaterials.

UNIT-V:
Quantum Mechanics: Introduction– Planck's' law of black body radiation – Wien's law and Rayleigh-

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Jean's law from Planck's law – Photoelectric effect – Compton effect – de-Broglie hypothesis – Wave-particle duality – Physical significance of ψ – Born's interpretation of the wave function – Verification of matter waves by Davisson-Germer's experiment – Uncertainty principle – Schrodinger wave equation (time-dependent and time-independent) – Particle in infinite square well potential.

Text Books:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

Suggested Reading:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications,2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications,2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

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with effect from the Academic Year 2020-2021

20EEC01

BASIC ELECTRICALENGINEERING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To understand the behaviour of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis
2. To understand the basic principle of operation of AC and DC machines
3. To know about different types of electrical wires and cables, domestic and industrial wiring. safety rules and methods of earthing

Course Outcomes: After the completion of this course, the student will be able to

1. Understand the concepts of Kirchhoff's laws and to apply them in superposition, Thevenin's and Norton's theorems to get the solution of simple dc circuits
2. Obtain the steady state response of RLC circuits with AC input and to acquire the basics, relationship between voltage and current in three phase circuits.
3. Understand the principle of operation, the emf and torque equations and classification of AC and DC machines
4. Explain various tests and speed control methods to determine the characteristic of DC and AC machines.
5. Acquire the knowledge of electrical wiring, types of wires, cables used and Electrical safety precautions to be followed in electrical installations.
6. Recognize importance of earthing, methods of earthing and various low-tension switchgear used in electrical installations

UNIT-I

DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of first-order RL and RC circuits.

UNIT-II

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III

Transformers: Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation

UNIT-IV

DC and AC Machines: DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators.
DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors.
Three - Phase Induction Motors: Principle of operation, Applications,

UNIT-V

Electrical Installations: Electrical Wiring: Types of wires and cables, Electrical Safety precautions in

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handling electrical appliances, electric shock, first aid for electric shock, safety rules.
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Earthing (Elementary Treatment only), Elementary calculations for energy consumption

Text Books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989
3. D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009
4. P.V. Prasad, S. Sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013

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20EG C02

ENGLISH LAB

(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	1

Course Objectives: This course will introduce the students:

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behavior while developing their ability to discuss in groups and making oral presentations.

Course Outcomes: After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams, and discuss and participate in Group discussions.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material
6. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary –** weaving an imaginative story around a given picture.
9. **Information Gap Activity –** Writing a brief report on a newspaper headline by building on the hints given
10. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd., 2011
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016

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20PY C10

PHYSICS LAB
(CHEMICAL)

Instruction	4Periods / Week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2

Course Objectives:

The objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments
2. Understand the behaviour of the light experimentally
3. Analyze the physical properties of magnetic and dielectric materials
4. Familiarize with motion of electrons in electric and magnetic fields

Course Outcomes: At the end of the course, the student will be able to

1. Interpret the errors in the results of an experiment.
2. Demonstrate the wave nature of light experimentally
3. Utilize physical properties of magnetic and dielectric materials for various applications
4. Make use of lasers and optical fibers for engineering applications
5. Explain light induced phenomenon and motion of electrons in electric and magnetic fields

Experiments

1.	Error Analysis	:	Estimation of errors in the determination of time period of a torsional pendulum
2.	Fresnel's Biprism	:	Determination of wavelength of given monochromatic source
3.	Newton's Rings	:	Determination of wavelength of given monochromatic source
4.	Single Slit Diffraction	:	Determination of wavelength of given monochromatic source
5.	Diffraction Grating	:	Determination of wavelengths of two yellow lines of light of mercury lamp
6.	Malus's Law	:	Verification of Malus's law
7.	Double Refraction	:	Determination of refractive indices of O-ray and E-ray of given calcite crystal
8.	Polarimeter	:	Determination of specific rotation of glucose
9.	Laser	:	Determination of wavelength of given semiconductor laser
10.	Optical Fiber	:	Determination of numerical aperture and power losses of given optical fiber
11.	Dielectric constant	:	Determination of dielectric constant of given PZT sample
12.	M & H Values	:	Determination of magnetic moment M of a bar magnet and absolute value Hof horizontal component of earth's magnetic field
13.	B-H curve	:	Determination of hysteresis loss of given specimen
14.	Planck's constant	:	Determination of Planck's constant using photo cell
15.	e/m of an Electron	:	Determination of specific charge of an electron by J.J. Thomson method

NOTE: A minimum of TWELVE experiments should be conducted.

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with effect from the Academic Year 2020-2021

20EEC02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements and to verify the basic electrical circuit laws and theorems.
2. To determine the parameters and power factor of a coil, calculate the time and frequency responses of RLC circuits and to familiarize with measurement of electric power & energy.
3. To determine the characteristics of Transformers, dc, ac machines and switchgear components

Course Outcomes: At the end of the course, the students are expected to

1. Get an exposure to common electrical components, their ratings and basic electrical measuring equipment.
2. Make electrical connections by wires of appropriate ratings and able to measure electric power and energy.
3. Comprehend the circuit analysis techniques using various circuital laws and theorems.
4. Determine the parameters of the given coil and calculate the time response of RL & RC series circuits.
5. Recognize the basic characteristics of transformer and components of switchgear.
6. Understand the basic characteristics of dc and ac machine by conducting different types of tests on them.

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components.
2. Verification of KCL and KVL.
3. Time response of RL and RC series circuits.
4. Determination of parameters of a choke or coil by Wattmeter Method
5. Verification of Thevenin's and Norton's theorems
6. Turns ratio /voltage ratio verification of single phase Transformers
7. Open Circuit and Short Circuit tests on a given single phase Transformer
8. Observation of Excitation Phenomenon in Transformer
9. Measurement of three phase power in a balanced system using two Wattmeter method.
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle)
11. Load test on DC Shunt motor
12. Speed control of DC Shunt motor
13. Demonstration of Low Tension Switchgear Equipment/Components
14. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: TEN experiments to be conducted from the above list.

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20ME C01

CAD AND DRAFTING

Instruction	1 T + 3 D Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives:
1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

Outcomes: At the end of the course, the Students are able to
1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

List of Exercises:
1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice versa.

Text Books:

1. N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishers, 2012.
2. K.Venugopal, “Engineering Drawing and Graphics + AutoCAD”, New Age International Pvt.Ltd,2011.
3. Basanth Agrawal and C M Agrawal, “Engineering Drawing”, 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., “Engineering Drawing”, 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications,2011.

20MBC02

COMMUNITY ENGAGEMENT

Instruction	3 Hours per week (30 hours field work & 2 hours per week)
SEE	Nil
CIE	50 Marks
Credits	1.5

Course Objectives: The main Objectives of this Course are to:

1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

Course Outcomes: After the completion of this Course, Student will be able to:

2. Gain an understanding of Rural life, Culture and Social realities.
3. Develop a sense of empathy and bonds of mutuality with Local Communities.
4. Appreciate significant contributions of Local communities to Indian Society and Economy.
5. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
6. Utilise the opportunities provided by Rural Development Programmes.

Module I Appreciation of Rural Society

Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

Module II Understanding Rural Economy and Livelihood

Agriculture, Farming, Landownership, Water management, Animal Husbandry, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III Rural Institutions

Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees, Local Civil Society, Local Administration.

Module IV Rural Development Programmes

History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

Text Books:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

Journals:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).

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With effect from the academic year from 2019-20

CHAITANYABHARATHIINSTITUTEOFTECHNOLOGY(A)
Model Curriculum (with effect from 2019-20)
B. TECH (Chemical Engineering)

SEMESTER–III

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per week L	T	P/D	Scheme of Examination Duration of SEE in Hours	Maximum Marks CIE	SEE	Credits
THEORY									
1	18MT C 05	Mathematics-III	3	1	-	3	30	70	4
2	18CHC01	Technology of Surface Coatings and Oils	3	1	-	3	30	70	4
3	18CHC02	Chemical Engineering Thermodynamics-I	3	1	-	3	30	70	4
4	18CHC03	Numerical methods in Chemical Engineering	3	1	-	3	30	70	4
5	18CHC04	Material and Energy Balance computations	3	1	-	3	30	70	4
6	18EG M01	Indian constitution	2	-	-	2	-	50	Non credit
7	18EE M 01	Indian traditional knowledge	2	-	-	2	-	50	Non credit
PRACTICALS									
8	18CHC05	Numerical methods in Chemical Engineering Lab	-	-	2	2	15	35	1
9	18CHC06	Technology of Surface Coatings and Oils Lab	-	-	2	2	15	35	1
Total			19	05	4	-	180	520	22

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

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18MT C 05

MATHEMATICS-III

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course helps the students to understand the

1. To form PDE and to find its solution.
2. To solve wave and heat equations.
3. To learn the Laplace and Inverse Laplace transforms for solving engineering problems.
4. To learn Fourier transform and Z-transforms for solving engineering problems.
5. Learning the basic concepts of probability and Statistical Analysis.

Course Outcomes: At the end of the course, the students will be able to

1. Solve Linear and Non-Linear PDE's.
2. Solve One-Dimension Wave and Heat equations and Two Dimension Laplace equation.
3. Find Laplace transform and inverse Laplace transform and can solve Linear Differential equations.
4. Find the solutions of various Transforms.
5. Find moments of discrete and continuous random variables as well as familiar with distribution.

UNIT-I: Partial Differential Equations

Formation of Partial Differential Equations, Solution of First Order Linear Partial Differential Equations by Lagrange's Method, Solution of First Order Non-linear Partial Differential Equation by Standard types and Charpits Method.

UNIT-II: Applications of Partial Differential Equation

Solution by Method of Separation of Variables, Solution of One dimensional Wave equation, One dimensional Heat equation, Two dimensional Laplace equation and its related problems.

UNIT-III: Laplace Transform

Laplace Transform of standard functions, Linearity property, change of scale property. Shifting theorems, Laplace Transform of Periodic Function, Unit step function and Unit impulse function. Transforms of derivatives, Transforms of integrals, Multiplication by t^n and division by t. Inverse Laplace Transform properties, Inverse Laplace Transform by partial fractions and Convolution theorem, Applications of Laplace Transform (Solution of Linear Differential Equations).

UNIT-IV: Fourier Transforms and Z-Transforms

Fourier Transforms: Fourier integral theorem (statement), Complex form of Fourier integrals. Fourier transforms, Inverse Fourier Transforms, Fourier Sine and Cosine transforms, Inverse Fourier Sine and Cosine Transforms. Properties of Fourier transforms: Linear property, change of scale property, shifting property and Modulation theorem.

Z-Transforms: Z-transforms of standard functions, linearity property, damping rule, shifting theorems, multiplication by 'n', initial and final value theorems. Inverse Z-Transform: Inverse Z-transform by Convolution theorem, partial fractions. Z-transform application to difference equations.

UNIT-V: Basic Statistics

Random variable, discrete probability distribution and continuous probability distribution. Expectation, Addition theorem and Multiplication theorem of expectation, properties of variance, Poisson distribution (Mean, variance, MGF & CGF), Normal distribution (Mean, variance, MGF & CGF), Properties of Normal distribution, Areas of under normal curve. Correlation and regression.

Text Books:

1. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 35th Edition, 2000.
3. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

Suggested Readings:

1. S. J. Farlow, "Partial Differential Equations for Scientists and Engineers", Dover Publications, 1993.
2. Ian Snedon, "Elements of Partial Differential equations", McGraw Hill, 1964.
3. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

18CH C 01

TECHNOLOGY OF SURFACE COATING AND OILS

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course helps the students to understand the

1. To give fundamental concepts in paints (including industrial paints and domestic paints)
2. Basic properties, uses of main ingredients like pigments, extenders, binders, solvents.
3. To know more about paint application systems (both air drying paints and stoving paints of liquid paints and power paints).
4. To impart knowledge on special coatings
5. To familiarize about sources, types and composition of oils and fats.

Course Outcomes: At the end of the course, the students will be able to

1. Identify the suitable paints for domestic and Industries.
2. Study more about specific paint manufactures.
3. Know main ingredients of paints, their manufacturers and properties.
4. Analyze the types of special paints and their application
5. Analyze the various properties of fats and oils to determine their use in food, soap and other industries

UNIT-I

Major components of surface coatings. Fundamentals of film formation, Classification of Paints: Air drying paints, stoving paints, their properties and uses. Liquid paints & powder paints, their properties & uses. Pigments: Importance of pigments - their basic properties, uses & their applications. Manufacture of Pigments: Titanium di-oxide, red lead.

UNIT-II

Extenders: Importance, properties & significance. Manufacture of Extenders: Blanc fixe, China clay, Gypsum, Mica & talc. Solvents: Importance, uses & their properties, Manufacture of solvents: Turpentine, Alcohols- Methyl Alcohol, Ethyl Alcohol, n-Propyl Alcohol.

UNIT-III

Manufacture of Paints: Distempers- Manufacture, properties & uses. Powder Paints-Manufacture, properties & uses. Enamel - Manufacture, properties &

uses. Application methods of paints: Air drying paints, industrial liquid stoving paints & industrial stoving powder paints. Brush application, Roller coating, spray application, electrostatic spray application.

UNIT-IV

Special Coatings: Importance, Significance & their applications. Powder Coatings, Water soluble coatings, aluminium coatings, water proof coatings, heat resistant coatings, automobile coatings, fire retardant coatings, space, air craft coatings, swimming pool coatings and Anti Micro growth Paints (Marine Paints).

UNIT-V

Introduction of Oils, Fats & Waxes, essential oils, their sources and composition. Types of Oils, Hydrogenation, Esterification and Interesterification, Saponification, Halogenation.

Text Books:

1. W.M. Morgans, "Outline of Paint Technology", Edward Arnold Publishers, London, 1990
2. R. Lambourne & T A Strivens, "Paint & Surface coatings", Second edition, 1999
3. Ed. D Swern, "Bailey's Industrial Oils and Fats Products", Wiley Inter Science publication, N.Y. John Wiley and Sons ,6th Edition, 2006

Suggested Readings:

1. Patton Temple, "C Pigment Flow & Pigment Dispersion", Wiley Inter science, 1979
2. Swaraj Paul, " Surface Coatings science and technology" , 1995
3. M M Chakrabarty , "Chemistry and Technology of Oils and Fats", Allied Publishers Pvt.Ltd., 1st Edition, 2007
4. O P Narula, "Treatise on fats,Fatty acids and Oleochemicals", Vol I and II, Industrial Consultants (India), 1994

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18CH C 02

CHEMICAL ENGINEERING THERMO DYNAMICS-I

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course helps the students to understand the

1. Basic thermodynamic laws and principles
2. Concept of energy conservation through the study of the first and second laws of thermodynamics
3. Concept of entropy and its importance in energy conversion
4. Identify, formulate and solve chemical engineering problems involving various types of systems and processes
5. Application of Thermodynamics to flow process

Course Outcomes: At the end of the course, the students will be able to

1. Understand the relation between the measurable nature of P, V, T and the un-measurable nature of H, U, A, G.
2. Use equations of state, correlations and tables for estimation of thermodynamic properties of real gases
3. Understand and analyze processes involving ideal gases, such as isothermal, isobaric, isentropic, cyclic
4. Apply energy balances to open and closed systems and to evaluate the thermodynamic efficiency of nozzles, compressors, turbines
5. Analyze steam power cycles; refrigeration cycles, and liquefaction

UNIT – I The First Law and Other Basic Concepts: Joule's Experiments - Internal Energy - Formulation of the first law of the thermodynamics - the thermodynamic state and state functions - Enthalpy - The steady state flow processes; equilibrium - the phase rule - The Reversible process - Constant V and constant P processes and heat capacity. Volumetric Properties of Pure Fluids: PVT behavior of pure substances, the Ideal gas, virial equations and their use in the calculation of P-V-T Properties; use of Cubic equations of state (Van der Waals and Redlich-Kwong), generalized correlations for gases

UNIT– II Second law of thermodynamics: Statement of the second law, heat engines, thermodynamic temperature scales, thermodynamic temperature and ideal-gas scale, entropy, entropy changes of an ideal gas, mathematical statement of the second law, the third law of thermodynamics, entropy from the microscopic view point.

UNIT – III Thermodynamic properties of fluids; Relationships among thermodynamic properties for a homogenous phase of constant composition; Maxwell relations, Residual properties; Two-phase systems. Thermodynamic diagrams; generalized property correlations for gases

UNIT – IV Conversion of Heat into Work by Power Cycles: Steam power plants; Carnot cycles; Rankine cycle; Otto cycle, Diesel cycle
Refrigeration and Liquefaction: the vapor - compression cycle; comparison of Refrigeration cycles; the choice of refrigerant; absorption refrigeration; the heat pump; various processes for liquefaction.

UNIT – V Thermodynamics of Flow Processes: Energy balances for steady state flow process; Application of thermodynamics to flow processes-pumps, compressors and turbines; calculation of ideal work and lost work for flow processes

Text Books:

1. Introduction to Chemical Engineering Thermodynamics (in SI units) by J M Smith and H C Van Ness and M M Abbott, 7th edition, Mc-Graw Hill International Edition, 2005

Suggested Readings:

1. A Textbook of Chemical Engineering Thermodynamics by K.V. Narayanan, PHI Pvt. Ltd., 2001
2. Chemical Engineering Thermodynamics by Y V C Rao, Universities Press, 1997
3. M J Moran, H N Shapiro, D D Boettner and M B Bailey, Principles of Engg. Thermodynamics, 8th Edition, Willey, 2018.

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18CH C 03

NUMERICAL METHODSIN CHEMICAL ENGINEERING

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course objectives: This course helps the students to understand the

1. Error analysis for various numerical methods
2. Appropriate numerical methods to solve non-linear algebraic and transcendental equations and linear system of equations
3. Appropriate numerical methods to approximate a function
4. Appropriate numerical methods to solve an ordinary differential equation
5. Various techniques to solve Partial differential equations

Course outcomes: At the end of the course, the students will be able to

1. Perform an error analysis for a given numerical method
2. Solve a linear system of equations and non-linear algebraic or transcendental equation using an appropriate numerical method
3. Calculate a definite integral and evaluate a derivative at a value using an appropriate numerical method
4. Solve an Ordinary differential equation using an appropriate numerical method
5. Solve partial differential equations using an appropriate numerical method

UNIT-I

Introduction, Approximation and concept of Error and Error Analysis: Taylor series expansion, Truncation error. Round-off error vs. Chopping-off error. Propagation of Error.
Linear Systems and Equations Matrix representation, Calculation of Eigen Values and Eigen vectors, Solution by Cramer's rule; Iterative Method— Jacobi iteration; Gauss-Seidel Method,
Chemical Engineering Examples: Material and energy balance problems involving at least 3 simultaneous equations

UNIT-II

Non-linear Algebraic Equations (single and multi variable) Bisection, Newton-Raphson and Secant methods, Multivariate Newton's method

Chemical Engineering Examples: Equation of state (van der Waals, Beattie-Bridgeman, etc.), Friction factor equation etc.

UNIT-III

Interpolation and Approximation: Newton's polynomials and Lagrange polynomials, spline

Interpolation, linear regression, polynomial regression, least square regression.

Chemical Engineering Examples: Free settling velocity of particles, Arrhenius Equation, Specific heat w.r.to temperature etc.

Numerical integration: Trapezoidal rule, Simpson's rule, integration with unequal segments, quadrature methods, Chemical engineering problems involving numerical differentiation and integration- Rayleigh's equation, Rate equation

UNIT-IV

Ordinary Differential Equations: Euler method, Runge-Kutta method, Adaptive Runge-Kutta method, Explicit Adams-Bashforth technique, Implicit Adams-Moulton technique, Predictor-Corrector technique.

Initial and boundary value problems: Orthogonal Collocation, shooting techniques

Chemical Engineering Examples: Rate equation, Steady-state material or energy balance equations etc.

UNIT-V

Solution of partial differential equations: Introduction to Partial Differential Equations, Classification of partial differential equations (PDE's), solution of PDEs by Finite difference techniques, implicit and explicit methods, Cranks Nicolson Method.

Chemical Engineering Examples: unsteady-state one dimensional heat conduction/diffusion equations

Text Books:

1. Numerical Methods for Engineers, Gupta S.K.; 3rd Ed; New Age International, 1995.
2. Numerical Methods for Engineers, Chapra S.C. and Canale R.P.; 5th Ed; McGraw Hill, 2006.
3. Numerical Methods, M. K. Jain, S. R. K. Iyengar, and R. K. Jain, 6th New Age International Publishers, New Delhi, 2012.

Suggested Readings:

1. Introductory Methods of Numerical Analysis, S. S. Sastry, 4th Ed, PHI Learning Pvt. Ltd., 2005
2. Introduction to Numerical Methods in Chemical Engineering, Pradeep Ahuja, PHI Learning Pvt. Ltd., 2010

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18CH C 04

MATERIAL AND ENERGY BALANCE COMPUTATIONS

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course will help the students to understand the

1. Basis for all further chemical engineering courses that are part of the curriculum.
2. Basic calculations of process engineering.
3. Material balance calculations for with and without chemical reactions.
4. Analysis methods for identifying vapors and liquids
5. Energy balance calculations and its importance.

Course outcomes: At the completion of this course, students will be able to

1. Develop mastery over process calculations relevant to chemical engineering processes
2. Handle elementary flow-sheeting, material and energy balance calculations without and with chemical reactions,
3. Understand different concepts like recycle, bypass and purge.
4. Familiarize with equations of state and properties of gases and liquids, including phase transition
5. Write the energy balance equations for different unit operations

UNITI

Basic concepts- Introductory concepts of units, physical quantities in chemical engineering, dimensionless groups, "basis" of calculations. Mass and volume relations.

UNITII

Material Balance: Introduction, Solubility, dissolution and crystallization (single solute systems) – Solving material balance problems without chemical reaction. Unit operations like absorption, distillation, evaporation, crystallization, leaching, and extraction, drying and mixing units under steady state conditions.

UNIT–III

Material Balance with Chemical Reaction: Material Balance with chemical reaction, Concept of stoichiometry and mole balances, examples, including combustion-Proximate and ultimate analysis of coal and analysis of flue gas. Material balances for by-pass, recycle and purge Operations.

UNIT – IV

Gases, Vapours and Liquids: Equations of state, Vapour pressure, Clausius-Clapeyron equation, Cox chart, Duhring's plot, Raoult's law. Humidity and Saturation, humid heat, humid volume, dew point, humidity chart and its use.

UNIT – V

Energy balance: Heat capacity, sensible and latent heat – Heat balances in operations involving phase change – Heat balance over heat exchangers, dryers and simple evaporation systems / Heat balances calculation in processes without chemical reaction- Heat of reaction, Heat of formation, Heat of combustion- Heat balance in reactions, Adiabatic reaction, temperature of products-Heating values of fuels.

Text Books

1. Himmelblau, D. M., Riggs, J. B. "Basic Principles and Calculations in Chemical Engineering", Eighth Ed., Pearson India Education Services, 2015.
2. Bhatt, B. I., Vora, S. M., "Stoichiometry", Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2004.

Suggested Readings:

1. Felder, R. M.; Rousseau, R. W., "Elementary Principles of Chemical Processes", Third Edition, John Wiley & Sons, 2000
2. Hougen, O. A., Watson, K. M., Ragatz, R. A., " Chemical Process Principles, Part-I Material & Energy Balances", Second Edition, CBS Publishers & Distributors, 2004
3. Venkataramani, V., Anantharaman, N., Begum, K. M. Meera Sheriffa, "Process Calculations" , Second Edition, Prentice Hall of India, 2015.
4. Sikdar, D. C., "Chemical Process Calculations", Prentice Hall of India, 2013.

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18EG M 01

INDIAN CONSTITUTION

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks

Course Objectives: This course will help the students to understand the

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course outcomes: At the completion of this course, students will be able to

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right To Liberty.

Unit-I

Constitution of India - Introduction and salient features . Constitutional history. Directive Principles of State Policy - Its importance and implementation.

Unit II

Union Government and its Administration - Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States.

Parliamentary form of government in India. President: role, power and position.

Unit III

Emergency Provisions in India - National emergency, President rule, Financial emergency

Unit IV

Local Self Government - District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

Unit V

Scheme Of The Fundamental Rights & Duties: Fundamental Duties - the legal status.

Scheme Of The Fundamental Rights - To Equality, to certain Freedom Under Article 19, to Life And Personal Liberty Under Article 21.

Suggested Readings:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

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18EE M 01

INDIAN TRADITIONAL KNOWELDGE

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks

Course Objectives:

1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Course Outcomes: After completion of this course, students will be able to:

1. Understand philosophy of Indian culture
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras.

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II

Indian Languages, Culture and Literature:

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV

Fine arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT-V

Education system in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. Kapil Kapoor, Text and Interpretation: The India Tradition, ISBN: 81246033375, 2005
2. Science in Samskrit, Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. S. Narain, Examinations in ancient India, Arya Book Depot, 1993
4. Satya Prakash, Founders of Sciences in Ancient India, Vijay Kumar Publisher, 1989
5. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Readings:

1. Kapil Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
2. Karan Singh, A Treasury of Indian Wisdom: An Anthology of Spiritual Learn, ISBN: 978-0143426158, 2016.

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18CH C 05

NUMERICALMETHODSINCHEMICALENGINEERING LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

List of Experiments

1. Introduction to use of computers for numerical calculations (1 practical turn)
2. Solution of linear algebraic equations using Gauss elimination, Gauss-Siedel etc. (2 practical turns)
3. Solution of a non-linear equations using bracketing and Newton-Raphson method (2 practical turns)
4. Interpolation and Approximation(2 practical turns)
5. Numerical integration(2 practical turns)
6. Euler method (1 practical turn)
7. Runge-Kutta methods for ODEs (2 practical turns)
8. Solution of system of ODEs using simple methods (1 practical turn)
9. Solution of simple PDEs (2 practical turns)

Text Books:

1. Numerical Methods for Engineers, Gupta S.K.; New Age International, 1995
2. Numerical Methods for Engineers, Chapra S.C. and Canale R.P.; 5th Ed; McGraw Hill 2006

Suggested Readings:

1. Introductory Methods of Numerical Analysis, S. S. Sastry, 4th Ed, PHI Learning Pvt. Ltd., 2005
2. Introduction to Numerical Methods in Chemical Engineering, Pradeep Ahuja, PHI Learning Pvt. Ltd., 2010

18CH C 06

TECHNOLOGY OF SURFACE COATINGS AND OILS LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

List of Experiments

1. Preparation of panels for painting (power coating or liquid paints)
2. Powder particles size analyser
3. Determination of apparent viscosity of paints (only liquid paints)
4. Determination of resistance to scratching under a specified load
5. of a dried film of paint
6. Measurement of paint film thickness using dry film thickness gauge (finish paint)
7. Determination of flexibility and adhesion of the paints (as per 101 BS 3960 m and size ¼ inch)
8. Determination of impact resistance of the painted panel
9. Measurement of hardness of magnesium phosphate coating or zinc phosphate coating
10. Measurement of gloss of painted film at 45 degree angle
11. Determination of drying consistency of different paints
12. Determination of coverage or spreading capacity of different paints
13. Salt Spray Test (only for Powders)
14. Determination of Acid value of given samples
15. Determination of percentage of free fatty acid present in the given
16. sample and its acid value
17. Determination of Iodine value of given sample
18. Determination of saponification value of given oil samples

Text Books:

1. Industrial Hand Books
   a). Berger Protection Protective Coatings – Product Data Manual
   b). Goodlass Nerolac Paints Product Data Manual
2. ICI Paints Quality Manual Book
3. A text book of oil and fat analysis By Cocks & Reid
4. Modern Technology in Oils and Fats Industry, Vol-II, OTAI (NZ)

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B.TECH (Chemical Engineering)

SEMESTER–IV

S.No	Course Code	Title of the Course	Schemeof Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18CSC05	Basics of Data Structures	2	-	-	3	20	50	2
2	18CHC07	Chemical Engineering Thermodynamics-II	3	1	-	3	30	70	4
3	18CHC08	Fluid mechanics	3	1	-	3	30	70	4
4	18CHC09	MaterialScience	3	-	-	3	30	70	3
5	18MEC09	Principlesofmanagement	3	-	-	2	30	70	3
6	18CEM01	Environmentscience	2	-	-	2	-	50	Non credit
PRACTICALS									
7	18EGC03	Softskillslab	-	-	2	2	15	35	1
8	18CSC06	BasicsofDatastructures	-	-	2	2	15	35	1
Total			**16**	**02**	**04**	-	**170**	**450**	**18**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

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18CS C 05

BASICS OF DATA STRUCTURES

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	20 Marks
Credits	2

Course Objectives: This course will help the students to understand the

1. Basic linear and non-linear data structures.
1. Analyzing the performance of operations on data structures.
2. Different sorting and searching techniques and their complexities.

Course outcomes: At the completion of this course, students will be able to

1. Understand the basic concepts of data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Choose and apply an appropriate data structure for a specified application.
4. Understand the concepts of recursion and its applications in problem solving.
5. Demonstrate a thorough understanding of searching and sorting algorithms.

UNIT-I

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff. Recursion: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT-II

Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

UNIT-III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications.

UNIT-IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT-V

Graphs:Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.

Searching and Sorting: Linear searching, binary Searching, sorting algorithms- bubble sort, selection sort, quick sort, heap sort.

Text Books:

1. Narasimhaarumanchi, Data Structures and Algorithms Made Easy, Career Monk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, Fundamentals of Data structures in C,E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, Data Structures using C, Oxford University Press, 2014.

Suggested Readings:

1. D.S.Kushwaha and A.K.Misra, Data structures A Programming Approach with C, PHI, 2011.
2. Seymour Lipschutz, Data Structures with C, Schaums Outlines Series, 1st Ed, 2001.

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18CH C 07

CHEMICALENGINEERINGTHERMODYNAMICS-II

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course will help the students to understand the

1. Concepts of fugacity, activity coefficient, vapor-liquid equilibrium and reaction equilibrium
2. Concepts of partial molar properties and chemical potential
3. Phase Rule and Various models used to determine the activity coefficients.
4. Generate Vapor- Liquid equilibrium (VLE) in form of T-X-Y or P-X-Y for binary mixtures
5. Concepts of chemical reaction equilibrium

Course outcomes: At the completion of this course, students will be able to

1. Calculate partial molar, residual and excess properties
2. Calculate Fugacity and Fugacity Coefficients for miscible binary Mixtures and also pure species
3. Determine the activity coefficients using various models
4. Generate equilibrium data for VLE
5. Determine equilibrium constant and composition of product mixture at given temperature and pressure

UNIT-I

Criterion of phase equilibrium; Ideal solutions and use of Raoult's Law to generate P-X-Y and t-x-y diagrams for ideal solutions; flash calculations for ideal solutions; non ideal behavior, partial properties; Gibb's – Duhem equation; fugacity and fugacity coefficient for pure components and for species in solution; calculations of fugacity coefficient using generalized correlation; the excess Gibbs energy; Lewis – Randall rule – activity coefficients from vapor-liquid equilibrium (VLE) data

UNIT-II

The nature of Phase equilibrium: the phase rule, Duhem's theorem; description of phase diagrams; low pressure VLE from correlation of data – equations of Margules, van Laar, Wilson, UNIQUAC, UNIFAC; dew-point and bubble – point calculations; flash vaporization calculations; ideal solute behavior based on Henry's law.

UNIT–III

Solution thermodynamics: fundamental residual – property relation and fundamental excess – property relation; evaluation of partial properties and property changes of mixing;

Phase Equilibria: equilibrium and stability; stability requirement for binary vapor-liquid equilibrium; Liquid-Liquid Equilibria; Vapor-Liquid-Liquid Equilibria; Solid-Liquid Equilibria; Solid-Gas Equilibria

UNIT-IV

Applications of equations of state; thermodynamic property calculations for fluid mixtures using the generalized correlation's based on the viral equation of state; properties of fluid mixtures using Redlich-Kwong equation of state and Pitzer's correlation's; VLE and flash calculations using the Redilich –Kwong equation of state

UNIT-V

Chemical reaction equilibrium; reaction co-ordinate; equilibrium criteria for chemical reactions; equilibrium constant and the effect of temperature; temperature and pressure effects on conversion; calculation of equilibrium conversion for single reactions in homogenous and heterogeneous systems; Duhem's theorem for reacting systems; simple examples of multi-reaction equilibrium.

Text Books:

1. Introduction to Chemical Engineering Thermodynamics (in SI units) by J M Smith and H C Van Ness and M M Abbott, 7th Edition, Mc-Graw Hill, 2005

Suggested Readings:

1. S.Sandler, "Chemical, Biochemical and Engineering Thermodynamics" , 4th edition, Wiley, India, 2006.
2. A Textbook of Chemical Engineering Thermodynamics by K.V. Narayanan, PHI Pvt. Ltd., 2001
3. Chemical Engineering Thermodynamics by Y V C Rao, Universities Press, 1997

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18CH C 08

FLUID MECHANICS

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course will help the students to understand the

1. Fluid flow phenomena for incompressible and compressible fluids.
2. Conservation of momentum principles to fluid flow.
3. Flow in Pipes, Channels and flow past immersed bodies.
4. Concepts of Compressible Fluids and Non Newtonian fluids
5. Fluidization phenomena and methods for transporting the fluids

Course outcomes: At the completion of this course, students will be able to

1. Differentiate different types of fluids.
2. Identify equipments to be used to measure fluid flow based on their properties.
3. Design the piping for flow of fluids under different conditions useful for industry.
4. Calculate the energy losses during the transport of fluids through pipes.
5. Deicide the types of pumps for different fluids under different conditions such as toxic, acidic, slurry type.

UNIT-I

Fluid Flow Phenomena and Fluid Statics: Definition of fluid, shear rate and shear stress, Newtonian and Non-Newtonian fluids, Time dependent flow, viscosity and momentum flux, compressible, incompressible, real and ideal fluids, viscosities of gases and liquids, Laminar and Turbulent flows, Reynolds experiment, Boundary layers, Hydrostatic equilibrium, U-tube manometer, inclined manometer and two fluid manometer and inverted manometer.

UNIT-II

Basic Equations of Fluid Flow: path lines, stream lines and stream tube, mass balance–equation of continuity, one dimensional flow, mass velocity, differential momentum balance- equations of motion, coquette flow, macroscopic momentum balances, momentum of stream and momentum correction factor, layer flow with free surface. Mechanical energy equation-Bernoulli equation- corrections for effects of solid boundaries, kinetic energy correction factor, corrections for fluid friction, pump work in Bernoulli equation.

UNIT-III

Incompressible Flow in Pipes and Channels and Frictional Losses: Shear stresses and skin friction, fanning friction factor, flow in noncircular channels, laminar flow of Newtonian and Non-Newtonian fluids, velocity distribution, Hagen-Poiseuille equation, Turbulent flow, universal velocity distribution, Roughness, Moody's friction factor chart. Pipes and valves, fittings. Friction losses due to sudden expansion and contraction, Effects of fittings and valves, form frictional losses in the Bernoulli Equation. Dimensional analysis and Buckingham ð - theorem and Rayleigh theorem its applications and limitations.

UNIT–IV

Compressible Fluids and Non Newtonian fluids (with Differential Pressure estimation) Flow past immersed bodies and Fluidization: Motion of particles through fluids – Free settling and hindered settling, Potential flow, vortisity. Differential analysis: mass and momentum balances, Navier-Stokes equation, Unidirectional flow, Viscous flow, Stokes law, Skin drag and pressure drag and drag coefficient, Flow through packed beds of solids – Kozeny- Carman equation, Burke-Plummer equation and Ergun equation. Boundary layer theory, Blasius solution, Boundary layer separation, Drag and lift force on immersed body.

UNIT – V

Transportation and Metering of Fluids: Centrifugal and Positive Displacement Pumps, Characteristics of pumps, selection and design of pumps, suction lift and cavitation, NPSH, Flow meters- Venturi meter, orifice meters, Pitot tube, Rota meters and Notches and Weirs, Compressors and blowers.

Text Books

1. W. L. McCabe, J. C. Smith and P.Harriott , Unit Operations of Chemical Engineering, 7th Ed., Tata-McGraw Hill Chemical Engineering Series, New Delhi, 2005.
2. C.J.Geankopolis, "Transport processes and unit operations", 3rd Ed., Prentice Hall Publishers, USA, 1993.

Suggested Readings:

1. James O. Wilkes, "Fluid Mechanics for Chemical Engineers with Microfluids and CFD", 2nd Ed., University of Michigan, Prentice Hall Intl., 2006.
2. Kurmi, R.S., "Hydraulics, Fluid Mechanics and Hydraulic Machines", 20th Ed., S. Chand and Company Pvt.Ltd., New Delhi, 2014.

18CH C 09

MATERIAL SCIENCE

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Basic introduction to different classes of materials relevant to engineering in general and chemical engineering in particular.
2. Significance of different properties for selecting material under different combinations of process conditions.
3. Concept of Semi crystalline and Bio materials.
4. Concept of Nano composite materials
5. Experimental techniques for material characterization.

Course outcomes: At the completion of this course, students will be able to

1. Identify the different classes of materials relevant to engineering
2. Apply the basic fundamentals of engineering for material selection based on their properties
3. Select semi-crystalline materials and bio materials.
4. Select materials for Nano composites.
5. Characterize material using different experimental techniques.

UNIT – I Introduction to Engineering Materials:

Classification – metals, non-metals, alloys; Ferrous metals and alloys - types of steels like mild, carbon and stainless steel, common grades of steel – 304 and 316; Non-Ferrous metals and alloys of Aluminium, Copper and Nickel; Criteria for material selection.

UNIT – II General Properties of Engineering Materials:

Mechanical Properties: Stress-strain diagram, Elastic, Plastic, Anelastic and Viscoelastic behavior. Creep, Fatigue and Fracture strengthening mechanisms. Thermal Properties: Conductivity, Expansion, Protection, Diffusivity, Stresses and Shock resistance. Optical Behavior: Light & electro-magnetic spectrum, Luminescence, stimulated emission of Radiation, Lasers, Optical fibres.

UNIT-III

Semi-crystalline materials: Classification, structure and configuration of ceramics, polymers,
copolymers, liquid crystals and amphiphiles

Non-crystalline/amorphous materials: Silicates, glass transition temperature, viscoelasticity.

Biomaterials: Interaction of materials with bioenvironment, concept of biocompatibility. Need for biomaterials, significant types – inert, surface active and resorbable materials. Their advantages, properties, uses.

UNIT-IV

Polymer nano-composite materials: Nanocomposites, role of reinforcement-matrix interface strength on composite behaviour. Corrosion, Degradation and Recycling

UNIT-V

Introduction to experimental techniques: XRD, NMR, PSA, etc. for material characterization highlighting links between molecular structure and macroscopic properties

Text Books

1. William D. Callister, David G, Rethwisch Materials Science and Engineering: An Introduction, Wiley Publisher, 2002.

2. V. Raghavan Materials Science and Engineering: A First Course, 5th Ed., Prentice Hall India, 2004.

Suggested Readings:

1. S. Upadhyaya and A. Upadhyaya, Material Science and Engineering, Anshan Publications, 2007.
2. B. S. Mitchell An Introduction to Materials Engineering and Science for Chemical and Materials Engineers, John Wiley & Sons, 2004.

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18ME C 09

PRINCIPLES OF MANAGEMENT

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To make the students to

1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

Course Outcomes: At the end of the course, student will be able to understand

1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT-I

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT-II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT-III

Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT-IV

Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT-V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, "Management", 10/e., Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, "Management", 6/e., Pearson Education, 2004.

Suggested Readings:

1. P.C. Tripathy & P.N. Reddy, "Principles of Management", Tata McGraw Hill, 1999
2. Harold Koontz and Cyril O'Donnell "Principles of Management'', Tata McGraw Hill, 2017

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18CE M 01

ENVIRONMENTAL SCIENCE

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks

Course Objectives: To enable the student:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: At the end of the course, the student should have learnt

1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT–I:

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT–II:

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT–III:

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT–IV:

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT–V:

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria& Sons, 2009.

Suggested Readings:

1. C. S. Rao," Environmental Pollution Control Engineering", Wiley, 1991.
2. S. S. Dara, "A Text Book of Environmental Chemistry &Pollution Control", S. Chand Limited, 2006

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18EG C 03

SOFT SKILLS LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The course will introduce the students to:

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: After successful completion of the course the students will be able to

1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise 1

Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.

Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)

Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise 2

Main Topics: Advanced Group Discussion with Case studies : Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)

Writing Input: Writing with Precision - Writing Abstracts

Exercise 3

Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.

Flipped Sessions: Mock Interviews (Video Sessions & Practice)

Writing Input: Writing to Reflect - Resume Writing

Exercise 4

Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity

Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)

Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5

Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.

Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)

Writing Input: Writing to Record - Writing minutes of meeting.

Suggested Readings:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010
4. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

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18CS C 06

BASICS OF DATA STRUCTURES LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: This course will help the students to understand the

1. Design and construct simple programs by using the concepts of Data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills while improving their practical knowledge in data structures.
4. To strengthen the practical ability to apply suitable data structure for real time applications.

Course outcomes: At the completion of this course, students will be able to

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implement non-linear data structures such as trees, graphs and its traversal techniques.
4. Implement various kinds of searching, sorting techniques.
5. Develop the suitable data structure for real world problem.

LIST OF EXPERIMENTS

1. Implementation of operations on arrays.
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of Sorting techniques.
7. Case study like Banking System, Students Marks Management, Canteen Management etc.

Text Books

1. Brian W Kernighan, Dennis Ritchie, C Programming Language, PH PTR, 2nd Edition.
2. Richard M Reese, Understanding and Using C Pointers,O'Reily , 2013.

Web Links

https://nptel.ac.in/courses/106102064/

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18CH C10 **CHEMICAL REACTION ENGINEERING I**

Instruction	3Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to

1. Analyze experimental kinetic data to determine reaction mechanisms.
2. Design different types of chemical reactors (Batch, Tube, and CSTR).
3. Assess the advantages and disadvantages of reactor types.
4. Understand the concepts of non ideal reactors.

Course Outcomes: At the end of the course students will be able to

1. Classify reactions, rate and forms of rate expressions.
2. Summarize fundamentals of kinetics and interpret the data including relationships between moles, Concentration, extent of reaction and conversion.
3. Explain Batch, CSTR, and PFR performance equations from general material balances for homogeneous and heterogeneous reactions.
4. Identify the right reactor among single, multiple, recycle reactors etc.
5. Apply the concepts of heat effects on reactions.
6. Analyze the non ideality of reactors.

UNIT-I

Introduction: Classification of Reactions, Definition - Variables affecting the rate of reaction. The rate equation and Stochiometric relations for a single phase reaction aA+bB $\rightarrow$ rR+sS. Single and multiple reactions, Elementary and non-Elementary reactions, Molecularity and order of Reaction, Specific reaction rate constant, Testing kinetic models – Steady state approximation, Equilibrium treatment, Fitting a rate law for the given reaction mechanism, predictability of reaction rate from theory. Temperature dependency from Arrhenius' law, Thermodynamics, Collision theory and Transition state theory, Comparison of theories with Arrhenius' law.

UNIT-II

Analysis and Correlation of experimental kinetic data: Constant volume batch reactor: Analysis of total pressure data, conversion. Integral method of analysis of data for single reaction, multiple reactions, Homogeneous catalyzed reactions, Auto catalytic reactions, Reversible reactions, and Reactions of shifting orders. Half life method, Partial analysis of the rate equation .Differential method of analysis of data.

Variable Volume Batch Reactor: Fractional change in volume of the system, Differential method of analysis, Integral method of analysis.

UNIT-III

Introduction to Reactor Design: Ideal reactors for a single reaction, generalized material balance, design equations-Ideal batch reactor, Space time – space velocity, Steady state mixed flow reactor, Steady state plug flow reactor, Holding time and space time for flow reactors, graphical interpretation. Design for single reactions, Size comparison of single reactors, Multiple reactor systems, Recycle reactor, Auto catalytic reactions – optimum recycle operation, Reactor combinations.

UNIT-IV

Design for Multiple Reactions: Series, Parallel and Independent reactions, Selectivity, Yield, Qualitative discussion about product distribution, Quantitative treatment of product distribution and of reactor size.

Temperature and Pressure effects for single reactions, Heat of reaction from thermodynamics, Heat of reaction and Temperature, Equilibrium constants and equilibrium conversions from Thermodynamics. General graphical design procedure, Optimum temperature progression. Heat effects, Adiabatic Operations, Non adiabatic operations. Exothermic reactions in mixed flow reactors – a qualitative treatment.

UNIT-V

Basics of Non-Ideal flow: The residence time distribution (R T D), State of aggregation of the flowing stream, earliness of mixing, Role of R T D, state of aggregation and earliness of mixing in determining reactor behavior. Exit age distribution of fluid, Experimental methods for finding E – pulse and step input experiments, Relationship between F and E curves. The convolution integral. Conversion in non- ideal flow reactors,

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Dispersion model-Axial dispersion and correlations for axial dispersion.

Text Books:

1. Octave Levenspiel, Chemical reaction Engineering, 3rd Ed, Wiley India Pvt.Ltd, New Delhi, 2006.

Suggested Reading:

1. J. M. Smith, Chemical Engineering Kinetics, McGraw – Hill , Third Edition, 1981
2. H. Scott Fogler, Elements of Chemical Reaction Engineering, Prentice Hall, Third Edition, 2002.

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18CH C11 **MASS TRANSFER I**

Instruction	3Hours per week
Duration of SEE	3 Hours
SEE	70Marks
CIE	30Marks
Credits	3

Course Objectives: This course helps the students to understand

1. Steady state, unsteady state diffusion mass transfer and determination of diffusivity in gas and liquids.
2. Mass transfer coefficients based on different mass Transfer Theories and their correlations with different analogies.
3. Description of Continuous and stage wise contact equipment- gas absorption and their equilibrium stages, number of transfer units.
4. Concept of distillation mass transfer operation and design the distillation column.
5. Concept of multi component distillation, azeotropic distillation and extractive distillation.

Course Outcomes: At the end of the course students will be able to

1. Apply the concepts of diffusion mass transfer to liquids and solids.
2. Estimate the mass transfer coefficients.
3. Design gas absorber by equilibrium method to find the number of theoretical stages.
4. Estimate the number of theoretical stages of distillation column using McCabe- Thiele and Ponchan-Savarit methods.
5. Explain extractive distillation and azeotropic distillation.

UNIT-I

Introduction: Diffusion and Mass Transfer – Mass transfer operations & their applications. Constitutive laws of diffusion, Molecular diffusion –Fick's first law – steady state molecular diffusion in binary3-\ mixtures of gases, liquids and solids – Determination of diffusivity in gases by Stefan-Maxwell method: estimation of diffusion coefficients in binary mixtures of liquids and gases by correlation; unsteady state diffusion

UNIT-II

Mass transfer coefficients: Convective mass transfer, inter phase mass transfer and mass transfer coefficients, Penetration theory, Surface Renewal Theory, Boundary Layer Theory. Mass transfer correlations for mass transfer coefficients and Reynolds & Colburn analogies. Effect of chemical reaction on mass transfer

UNIT-III

Gas – liquid contact: Description of Continuous and stage wise contact equipment, Equilibrium stages and transfer units: number and height of transfer units; stage efficiency.

Gas absorption plate and packed column design: Absorption and Stripping: counter current and co-current isobaric absorption and stripping of single component – Operating Lines – Minimum flow rates – Determination of number of plates – absorption factor. Determination of number of transfer units and height of a continuous contact plate and packed absorbers. Kremser – Brown equation for tray towers and packed towers, reactive absorption.

UNIT-IV

Distillation: VLE Phase diagrams – Tie lines and mixture rule – Flash vaporization and differential distillation for binary mixtures – Steam distillation. Batch distillation with reflux for binary mixtures. Continuous fractionation of binary mixtures, Ponchan – Savarit method, McCabe – Thiele method for determination of ideal plates for binary mixtures, Optimum reflux ratio, Use of total and partial condensers. Use of open steam, Packed bed distillation

UNIT-V

Introduction to multi component distillation, azeotropic distillation, extractive distillation

Text Books:

Binay K Dutta, Principles of Mass Transfer and Separation Processes,2nd edition, Prentice Hall of India,2007
R E Treybal, Mass Transfer Operations, 3rd Edition, McGraw Hill, New Delhi, 1983

Suggested Reading: C.J. Geankoplis, Transport Processes and Unit Operations, 3rd Edition, Prentice Hall, India, 1993

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18CH C 12 **HEAT TRANSFER**

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: This course will help the students to understand the

1. Basic concepts of heat transfer
2. Convective Heat Transfer and the concept of dimensional analysis
3. Concept and functioning of different heat exchangers
4. Heat transfer with change of phase and the functioning of evaporators
5. Radiation Laws and the concept of radiation shields, Design aspects of furnaces.

Course Outcomes: At the completion of this course students will be able to

1. Distinguish between different types of heat transfer
2. Analyze and understand the concepts of Heat exchangers
3. Calculate the rate of heat transfer with and without change of phase
4. Identify the type of evaporator required for a specific purpose and design it
5. Explain the impact of radiation shields and design aspects of furnaces.

UNIT - I

Fundamentals of Heat Transfer :- Modes of Heat Transfer, Derivation of Heat conduction equations in rectangular co-ordinates, thermal diffusivity, Differential equations of heat transfer-special forms – cylindrical co-ordinates system. One dimensional problem, heat transfer from extended surfaces, two dimensional problems, Lumped capacity systems, Insulation.

UNIT - II

Convective Heat Transfer: - Natural and forced convection in laminar and turbulent flow over plates and tubes. Dimensional Analysis, Thermal Boundary layer, Analogies and correlations. Design of Heat Transfer Equipment - Double Pipe Heat Exchanger, Concept of LMTD, Shell and tube Exchanger – Kern's method of design, Effectiveness - NTU methods, construction aspects in brief.

UNIT - III

Design aspects of finned tube and other compact heat exchangers. Basics of Heat Transfer with change of phase - Introduction to boiling. Types of boiling, Regimes of pool boiling and critical heat flux. Nucleate Boiling-Bubble formation, its growth and motion Introduction to condensation.

UNIT - IV

Derivation of Nusselt's equation. Design aspects of Condensers. Types of Evaporators, Capacity and Economy of Evaporators, Design aspects of Evaporators – Material and energy Balances of single and multiple effect evaporators. Heat Transfer to agitated vessels. Description and working of crystallizers

UNIT - V

Radiation – Fundamentals of Radiation Heat Transfer. Laws of black body Radiation. Radiation Shields .Radiating heat exchange between non black body surfaces. Design aspects of furnaces.

Text Books:

1. W.L.McCabe, J.C.Smirh and P.Harriott, 'Unit Operations of Chemical Engineering' 7th Edition,Tata-McGraw Hill, New Delhi , 2005
2. D.Q. Kern, 'Process Heat Transfer'1st Edition Tata-McGraw Hill Publishers, New Delhi, 2001
3. Holman, J.P.S. Bhattacharya. Heat Transfer, 10th Edition, Tata-McGraw Hill, 2011

Suggested Reading:

1. Coulson JM and Richardson, J.F, Chemical Engineering Series,Vol 1, 4th Edition, Pergamon Press Oxford, UK, 1991
2. B K Dutta, Heat Transfer Principles and applications, PHI Learning Pvt Ltd, New Delhi, 2004
3. C P Gupta and Rajender Prasad, Engineering Heat Transfer, NemChand and Brothers , New Delhi, 2010

18CH C 13 **PARTICLE AND FLUID-PARTICLE PROCESSING**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the
1. Numerous industrial operations dealing with the particulate solids, their handling in various unit operations, and those in which particle-fluid interactions are important.
2. Fundamentals of fluid-particle mechanics, such as the notion of drag, and builds on those fundamentals to develop design concepts for various industrial processes like packed bed operation, fluidized operations, sedimentation, filtration, separation of solids and fluids, etc.
3. Industrial applications
4. Colloidal systems, soft materials and nano particles. Applications of these novel systems are discussed.
5. Concepts of Filtration and transport of fluid-solid systems

Course outcomes: After the completion of the course students will be able to
1. Identify and describe fluid-particle systems in terms of their basic physical properties
2. Explain size reduction energy requirements, estimate performance of equipment, selection and sizing of equipment.
3. Find drag force and terminal settling velocity for single particles.
4. Determine pressure drop in fixed and fluidized beds.
5. Apply separation techniques sedimentation, flocculation to separate a solid fluid mixtures
6. Analyze filtration data and select systems based on requirements, estimate filtration area for given requirements, understand filter aids and their usage.

UNIT- I

Introduction: Relevance of fluid and particle mechanics, and mechanical operations, in chemical engineering processes.

Introduction to nanoparticles: Properties, characterization, synthesis methods, applications.

Solid particle characterization: Particle size, shape and their distribution; Relationship among shape factors and particle dimensions; Specific surface area; Measurement of surface area. Size reduction, milling, laws of communition, classification of particles.

Size enlargement; Nucleation and growth of particles

UNIT- II

Flow around immersed bodies: Concept of drag, boundary layer separation, skin and form drag, drag correlations

Packed bed: Void fraction, superficial velocity, channeling, Ergun equation and its derivation, Kozeny Carman equation, Darcy's law and permeability, Blaine's apparatus.

UNIT- III

Fluidization: Fluidized bed, minimum fluidization velocity, pressure drop, Geldart plot etc. Types of fluidization: Particulate fluidization, Bubbling fluidization, Classical models of fluidization, circulating fluidized beds, Applications of fluidization.

UNIT- VI

Separation of solids from fluids: Introduction

Sedimentation: Free Settling, hindered settling, Richardson-Zaki equation, design of settling tanks.

Colloidal particles: stabilization, flocculation.

Centrifugal separation, design of cyclones and hydro cyclones

UNIT- V

Filtration: Concepts, design of bag filters, design of electrostatic filters.

Transport of fluid-solid systems: pneumatic and hydraulic conveying.

Text Books:
1. McCabe W, Smith J and Harriott, P. Unit Operations of Chemical Engineering, 6th edition, McGraw Hill
2. Coulson and Richardson's Chemical Engineering, Vol. 2, Butterworth-Heinemann, 5th edition 2002

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Suggested Reading:

1. Rhodes M J, Introduction to Particle Technology, 2nd edition, John Wiley, Chichester; New York, 2008
2. Allen T, Powder Sampling and Particle Size Determination, Elsevier, 2003
3. Masuda H, Higashitani K., Yoshida H, Powder Technology Handbook, CRC, Taylor and Francis, 2006
4. Vollath D, Nanomaterials: An Introduction to Synthesis, Properties and Applications, 2nd Ed., Wiley, 2013

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18CH E 01 **WATER CONSERVATION AND MANAGEMENT**

(Core Elective I)

Instruction	3Hours per week
Duration of SEE	3 Hours
SEE	70Marks
CIE	30Marks
Credits	3

Pre-requisites: Environmental science (mandatory non-credit course)

Course Objectives: This course helps the students to understand:

1. Water sources, usage and need to protect them.
2. Water quality and standards
3. Water audits and testing methods.
4. Water management system.
5. Need for water conservation.

Course Outcomes: At the completion of this course, students will be able to

1. Identify the water storage methods in practice based on available sources and supply.
2. Understand the water quality parameters and analysis methods.
3. Classify the basic characteristics of water and their testing methods.
4. Explain the objectives of water harvesting and recycling methods.
5. Make use of water conservation methods at work place, agriculture, service and process industry.

UNIT – I Introduction:

Sources of water, Hydrologic cycle, multiple cycles – evaporation, precipitation, infiltration, runoff and subsurface flow. Composition of water sources like sea, rain, snow, river, lake. Need to protect water supplies, sources of water supply, types of water storage systems in practice.

UNIT – II Water quality and standards:

Physical, chemical and microbiological quality characteristics of water, water quality classification system in India, water quality parameters, standards of drinking water prescribed by different agencies, permissible limits of constituents of raw water supplied to industries, tolerance limits of industrial effluents, tolerance limits of inland surface water.

UNIT – III Water audits and testing:

Water rights and laws, water policy objectives, water quality related issues in India, major factors for water quality degradation, water quality – testing, preserving and control methods. Analysis of water –Physical, chemical and bacteriological tests practiced.

UNIT – IV Water management:

Water management services in India, key issues and principles of water management, integrated water resource management in India. Necessity and objectives of watershed management, approaches and practices, types of water harvesting– afforestation and rainwater harvesting, benefits, identifying locations. Water recycling – benefits, reuse drives.

UNIT – V Water conservation:

Water use, impacts and benefits, Water conservation methods, minimizing evaporation, water conservation practices and case studies in fields of agriculture, work place, service industry, process industry.

Text Books:

1. Elements of Water Pollution Control Engineering, OP Gupta, Khanna Publishing House, Delhi, 2019.
2. Glenn O. Schwab and R K Frevert, Water Conservation and Management Soil and Water Conservation Engineering, 3rd Ed., John Wiley & Sons, 1981

Suggested reading:

1. Water Supply and Sanitary Engineering, Rangwala, Charotar Publications, 2006.

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18CH E 02 **RENEWABLE ENERGY**

(Core Elective I)

Instruction	3Hours per week
Duration of SEE	3 Hours
SEE	70Marks
CIE	30Marks
Credits	3

Course Objectives: This course will help the students to understand

1. Concept of various forms of Renewable energy resources and Non-Renewable energy resources.
2. Outline division aspects and utilization of renewable energy sources for both domestics and industrial applications.
3. Identify Wind energy as alternate form of energy and to know how it can be tapped.
4. Concepts of thermo and bio-chemical process along with novel technologies to conversion of biomass to Bio fuel.
5. Environmental and cost economics of using renewable energy sources.

Course Outcomes: At the end of the course students will be able to

1. Describe the environmental aspects of non-conventional energy resources compared with various conventional energy systems, their prospects and limitations.
2. Explain the use of solar energy and the various components used in the energy production with respect to applications.
3. Find out the need of Wind Energy and the various components used in energy generation and know the classifications.
4. Understand the concept of Biomass energy resources and their classification, types of biogas Plants-applications
5. Summarize the knowledge of Ocean energy, tidal energy, Geothermal energy.
6. Understand the Fuel cells principles and applications.

UNIT- I

Introduction: Renewable and Non Renewable Energy Resources, World energy status, Current energy scenario in India, Environmental aspects of energy utilization, Energy and sustainable development.

UNIT- II

Solar energy basic concepts, Flat plate and Concentrating collectors, Solar Thermal Applications-Heating, Cooling, Desalination, Drying, Cooking etc. Solar pumping, Solar photo voltaic conversion, Solar cells.

UNIT- III

Wind energy availability, Wind power plants, Wind energy conversion systems, Site characteristics, Types of wind turbines.

UNIT- IV

Energy from biomass, Biomass resources, Biomass conversion technologies - Direction combustion, Pyrolysis, Gasification, Anaerobic digestion, Biogas Plants, Bioethanol and Biodiesel production

UNIT- V

Other Renewable Sources –Ocean Energy Resources, Principle of OTEC, Tidal energy, Geothermal energy, Hydroelectric Power. Fuel cell –Principle of working -Various types -Construction and applications

Text Books:

1. Bent Sorensen, Renewable Energy, Elsevier, Academic Press, 2011
2. Bridgurater A V, Thermochemical processing of Biomass, Academic Press, 1981
3. Kishore V V N, Renewable Energy Engineering and Technology", Teri Press, New Delhi, 2012
4. Kreith F and Kreider J F, Principles of Solar Engineering, McGraw-Hill, 1978

Suggested Reading:

1. Godfrey Boyle, Renewable Energy Power for a Sustainable Future, Oxford University Press, U.K, 1996
2. Peter Gevorkian, Sustainable Energy Systems Engineering, McGraw Hill,2007

3. Sukhatme S.P., Solar Energy, Tata McGraw Hill, 1984
4. Twidell J W and Weir A, Renewable Energy Sources, EFN Spon Ltd., 1986.10.Veziroglu T.N., Alternative Energy Sources,Vol 5 and 6, McGraw-Hill, 1990
5. Anthony San Pietro, Biochemical and Photosynthetic aspects of Energy Production, Academic Press, 1980

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18CH E 03 **EXPERIMENTAL AND ANALYTICAL TECHNIQUES**
(Core Elective I)

Instruction	3Hours per week
Duration of SEE	3 Hours
SEE	70Marks
CIE	30Marks
Credits	3

Course Objectives: This course will help the students to
1. Acquire knowledge about the widely used analytical Instruments
2. Essential chemical and physical principles of analytical techniques
3. Understand & select Instrument for a particular analysis with some idea of its merits, demerits and limitations
4. Practical aspects of classical chemical analysis
5. Work as a service and maintenance engineering for these Instruments

Course outcomes: At the end of the course students will be able to
1. Build basic knowledge of analytical techniques
2. Distinguish the applicability of Microscopy techniques
3. Identify the suitable spectroscopy methods
4. Select the electro-analytical techniques
5. Infer the role of different separation techniques

UNIT-I
Microscopy Techniques: scanning electron microscopy (SEM); secondary Auger microscopy (SAM); scanning probe microscopy (SPM); scanning tunneling microscopy (STM); transmission electron microscopy (TEM); upright microscope, inverted microscope, image analysis.

UNIT-II
Spectroscopy methods: FTIR, AAS, UV-VIS, UV-fluorescent, Wavelength and energy dispersive X-ray fluorescence spectroscopy (WDS and EDS); X-ray absorption spectroscopy (XANES and EXAFS); secondary ion mass spectrometry (SIMS); temperature programmed desorption (TPD); thermal desorption spectroscopy TDS), ICP-OES, XRD.

UNIT-III
Atomic absorption spectroscopy (AAS); inductively coupled plasma-atomic emission spectroscopy (ICP-AES).

UNIT-IV
Electro analytical Techniques: Voltametry; coulometry; amperometry; potentiometry; polarography; electrolytic conductivity; impedance spectroscopy, rotating disc electrode, rotating ring disc electrode.

UNIT-V
Separation Methods: Normal and reversed phase liquid chromatography (NP-& RP-LC); Gas Chromatography (GC); GC-MS; High Performance Liquid Chromatography (HPLC); Size-Exclusion Chromatography (SEC); Ion Chromatography (IC)

Text Books:

1. Wiesendanger, Scanning Probe Microscopy and Spectroscopy, Cambridge University Press, 1994
2. Frank A Settle, Handbook of instrumental techniques for analytical chemistry, Prince Hall, New Jersey, 1997

Suggested Reading:

1. D A Skoog, D M West, F. J. Holler and S. R. Couch, Fundamentals of analytical chemistry. Brooks/Cole Cengage learning, New Delhi, 2004
2. P Atkins and J de Paula, Atkins' Physical Chemistry, Oxford University Press, New Delhi, 8th Edition, 2008
3. K W Kolasinski, Surface Science: Foundations of Catalysis and Nano science, John Wiley and Sons, 2002

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18CH E 04 **POLYMER SCIENCE AND TECHNOLOGY**

(Core Elective II)

Instruction	3Hours per week
Duration of SEE	3 Hours
SEE	70Marks
CIE	30Marks
Credits	3

Course objectives: This course helps the students to understand

1. The fundamental - chemical, physical and mechanical behaviour of polymers.
2. The structure-processing-property relationship of polymers.
3. The processing techniques, along with the production of polymers.
4. The synthesis, manufacture, processing and characterization of different polymers
5. The basic issues involved in polymer blends, composites and nano composites.

Course Outcomes: At the end of the course students will be able to

1. Explain the basic concepts of polymers, polymerization techniques and behaviour in polymers
2. Distinguish different types of polymerization.
3. Determine the molecular weight of polymers by different techniques
4. Familiarize with various processing techniques for polymers, rubbers and fibers
5. Summarize the manufacturing and characterization of various industrially important polymers

UNIT - I

Definitions and concepts of terms used in polymer engineering, Classification of polymers; Polymer structures, functionality; polymerization reactions – mechanism of polymerization; stereospecific polymerization, copolymerization. Polymer material structure and Properties: Deformation, flow and melt characteristics. Morphology and order in crystalline polymers. Rheology and the mechanical properties of polymers. Polymer structure and physical properties

UNIT - II

Polymerization reactors, polymerization processes, characterization of polymers, analysis of polymerization reactions, polymer degradation, Condensation polymerization, Addition polymerization, Ionic and coordination polymerization.

UNIT - III

Molecular weight and molecular weight distribution in polymers, properties of polymers – physical, chemical, mechanical and electrical properties of polymers, elementary idea on polymer rheology, polymer blends. Experimental methods for molecular weight determination: cryoscopy, ebulliometry, membrane osmometry, light scattering method, viscometry, intrinsic viscosity measurement, gel permeation chromatography. Structure and Properties: Thermal transitions, Crystallinity, Molecular weight characterization, Nuclear Magnetic Resonance (NMR) and Fourier Transform Infrared (FTIR) techniques.

UNIT – IV

Polymer processing: modeling – compression & transfer, injection & jet; casting; extrusion, calendaring, lamination, spinning & finishing. Processing methods , effect of additives used, plasticizers, colourants, heat stabilizers, antioxidants, ultraviolet absorbers, antistatic agents, flame retardants, blowing agents, fillers etc. Molding techniques for plastics, injection molding, compression molding, calendaring, blow moulding, extrusion, thermoforming, spinning methods for fibres, compounding methods for elastomers, general study of elastomer processing methods.

UNIT - V

Industrial polymers: Manufacturing processes, properties and uses of Polyethylene, Polypropylene, Polyvinylchloride, Polystyrene, Nylon, Polyethylene terephthalate. Hydrocarbon plastics and elastomers. Other carbon chain polymers. Heterochain thermoplastics. Thermosetting resins. Polymer Blends: Types, Compatibility, Thermal and Mechanical Properties. Polymer Composites: Types, Properties, Preparation, Fibre-reinforced composites, In-situ composites. Polymer Nanocomposites: Basic concepts, Processing, Characterization.

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Text Books:

1. Text Book of Polymer Science, F. W. Billmeyer, John Wiley, New York, 1962
2. Polymer Science &Technology, P.Ghosh, TMC, 2001

Suggested Reading:

1. The elements of Polymer Science & Engineering, Alfred Rudin, Academic Press, 2nd Edition,1998
2. Introduction to Polymers, R. J. Young, Chapman & Hall, London, 1991

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18CH E 05 **GREEN TECHNOLOGY**

(Core Elective II)

Instruction	3Hours per week
Duration of SEE	3 Hours
SEE	70Marks
CIE	30Marks
Credits	3

Course Objectives: This course helps the students to understand
1. Green systems and the environment
2. Life cycle assessment
3. Environment sustainability
4. Alternative energy technologies and efficient process systems
5. Sustainable product production and utilization

Course Outcomes: At the end of the course students will be able to
1. Describe the principles of green chemistry
2. Identify manufacturing processes for waste minimization
3. Identify technologies to reduce the level of emissions
4. Understand the importance of eco-friendly solvents
5. Apply principles of green chemistry to design greener processes

UNIT – I

Principles and Concepts of Green Chemistry: Introduction, Sustainable Development and Green Chemistry, Rearrangement Reactions, Addition Reactions, Atom Un-economic Reactions, Substitution Reactions, Elimination Reactions, Wittig Reactions, Toxicity.

UNIT – II

Waste - Production, Problems and Prevention: Introduction, Some Problems Caused by Waste, Sources of Waste from the Chemical Industry, the Cost of Waste, Waste Minimization Techniques.
Measuring and Controlling Environmental Performance: The Importance of Measurement, Introduction to Life Cycle Assessment, Green Process Metrics and Environmental Management Systems.

UNIT – III

Emerging Greener Technologies and Alternative Energy Solutions: Design for Energy Efficiency, Photochemical Reactions, Advantages and Challenges Faced by Photochemical Processes, introduction to microwave heating and sonochemistry, Electrochemical Synthesis.

UNIT – IV

Organic Solvents and Volatile Organic Compounds: Solvent-free Systems, Water as a Reaction Solvent, Water-based Coatings, Ionic Liquids as Catalysts and Solvents.

UNIT – V

Designing Greener Processes: Conventional Reactors - Batch and Continuous, Inherently Safer Design, Process Intensification.
Inherently Safer Design: safety in design, case studies of major accidents
An Integrated Approach to a Greener Chemical Industry: Society and Sustainability, Barriers and Drivers, EU White Paper on Chemicals Policy, Green Chemical Supply Strategies.

Text Books:
1. Mike Lancaster, Green Chemistry, Royal Society of Chemistry,2010
2. Paul T Anastas, John C Warner, Green Chemistry: Theory and Practice, Oxford University Press,2000

Suggested Reading:
1. Jay Warmke, Annie Warmke, Green Technology, Educational Technologies Group, 2009
2. James Clark and Duncan Macquarrie, Handbook of Green Chemistry & Technology, Blackwell Publishing, 2002

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18CH E 06 **CATALYSIS**
(Core Elective II)

Instruction	3Hours per week
Duration of SEE	3 Hours
SEE	70Marks
CIE	30Marks
Credits	3

Course objectives: This course helps the students to understand
1. Different types of catalysts, their structures and synthesis processes
2. Mechanism and kinetics of heterogeneous catalysts
3. Physical and chemical catalytic properties
4. Applications of catalysis in processes
5. Catalytic reactions and reactor design

Course Outcomes: At the end of the course, student will be able to
1. Explain the basic concepts of catalysis
2. Summarize the methods of preparation and characterization of catalysts
3. Analyze the role of heat and mass transfer in the catalytic reactor design
4. Distinguish the performance of catalytic reactors
5. Identify the role of catalysts in the environmental protection
6. Explain the commercial aspects of catalytic reactors

UNIT – I
Catalysis: Introduction to Catalysis, Comparison of Catalyst Types, Basics of Heterogeneous and Homogeneous Catalysis.

UNIT – II
Basic concepts in heterogeneous catalysis: Catalyst preparation and characterization, Optimal distribution of catalyst in a pellet. Surface reactivity and kinetics of reaction on surfaces, poisoning and regeneration.

UNIT – III
Heat and mass transfer and its role in heterogeneous catalysis. Calculations of effective diffusivity and thermal conductivity of porous catalysts

UNIT – IV
Industrially important catalysts and processes such as oxidation, processing of petroleum and hydrocarbons, synthesis gas and related processes, Environmental catalysis. Zeolite catalysts, preparation, characterization and applications

UNIT – V
Commercial Catalytic Reactors (Adiabatic, fluidized bed, trickle bed, slurry etc.). Selection and design and preparation of catalysts

Text Books:

1. John Meurig Thomas, W. J. Thomas, Principles and Practice of Heterogeneous Catalysis, Wiley VCH; 2nd Edition, 2014
2. James John Carberry, Chemical and Catalytic Reaction Engineering, Dover Publications, INC,2001

Suggested Readings:

1. L K Doraiswamy, M MSharma, Heterogeneous Reactions: Fluid-fluid- solidReactions,Wiley,1984
2. B Viswanathan, S Sivasanker, and A V Ramaswamy, Catalysis: Principles and Applications ,Narosa Publishing House, 2002

18CH C 14 **CHEMICAL ENGINEERING LAB I A (MECHANICAL UNIT OPERATIONS)**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

List of Experiments

1. Verification of the laws of size reduction using Jaw crusher.
2. Verification of the laws of crushing using drop weight crusher and determination of work index.
3. Determination of laws of crushing in a pulverizer.
4. Verification of the comminution laws and critical speed of a ball mill
5. Analysis of various sizes of given material by sieve analysis and determination of cumulative and differential analysis.
6. Determination of the specific cake resistance and medium resistance in a vacuum filter or plate and frame filter press.
7. Calculation of the effectiveness of screen in horizontal and inclined position (vibrating screens)
8. Determination of separation factors of air and hydraulic classifiers.
9. Determine settling rate classification of particles using cyclone separator and to determine the efficiency
10. Determination of the froth flotation characteristics in mineral concentration

Text Books

1. W. L. McCabe, J. C. Smith and P.Harriott , Unit Operations of Chemical Engineering, 7th Ed., Tata-McGraw Hill Chemical Engineering Series, New Delhi, 2005.

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18CH C 15 **CHEMICAL ENGINEERING LAB I B**
(FLUID MECHANICS AND HEAT TRANSFER)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

List of Experiments

Fluid Mechanics

1. Determination of critical velocity by Reynolds Experiments.
2. Determination of friction factor for flow through pipes with bends of different diameters and study of variation of friction factor with Reynolds number.
3. Determination of friction factor for flow of water through annulus using Fanning's and Darcy's equations.
4. Determination of characteristic curves for centrifugal pumps.
5. a) Determination of friction factor for packed beds.
   b) Determination of minimum fluidization velocity

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Heat Transfer

1. Determination of interface temperatures in composite wall under steady state conditions.
2. Determination of heat transfer coefficient in Natural convection.
3. Determination of heat transfer coefficient in forced convection.
4. Determination of emissivity and Boltzmann's constant of a sample body
5. Determination of heat transfer area in a 1-2- shell and tube heat exchangers

Text Books:

1. B.K. Dutta, 'Heat Transfer Principles and applications', PHI Learning Pvt Ltd, New Delhi,2004.
2. W. L. McCabe, J. C. Smith and P.Harriott , Unit Operations of Chemical Engineering, 7th Ed., Tata- McGraw Hill Chemical Engineering Series, New Delhi, 2005.

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18CH C16 **CHEMICAL REACTION ENGINEERING – II**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives This course helps the students to understand

1. Basic Concepts of Catalysis
2. Kinetics and Mechanistic aspects of Catalysts
3. Design and Rating of Catalytic Reactors
4. Design Aspects of Gas-Liquid Reactors

Course Outcomes At the end of the course, a student will be able to

1. Indentify and characterize solid catalysts
2. Explain the kinetics for solid catalyzed reactions
3. Interpret the kinetics of fluid and particle reactions
4. Identify regions of mass transfer control and reaction rate control in fluid-fluid reactions
5. Apply the concepts to Gas fluid and catalytic reactors

UNIT – I

Solid Catalysts - Adsorption, adsorption isotherms, surface area, void volume and solid density, pore volume distribution. Theories of heterogeneous catalysis, classification of catalysts, catalyst preparation, promoters and inhibitors

UNIT – II

Solid Catalyzed Reactions - Introduction; Development of rate expressions from L- H - H - W models for reaction A + B ↔ R + S under adsorption, surface reaction and desorption controlling condition. Pore diffusion resistance combined with surface kinetics (Single cylindrical pore, first order reaction) Porous catalyst particles, mass and heat transfer within catalyst pellets. Experimental methods for finding rates.

UNIT – III

Kinetics of fluid-particle reactions: selection of a model, PCM, SCM, comparison of models with real situations. Shrinking core model for spherical particles of unchanging size: Diffusion through gas film controls, Diffusion through ash layer controls, chemical reaction controls. Rate of reaction for shrinking spherical particles.

UNIT – IV

Kinetics of fluid - fluid reactions: The rate equation for straight mass transfer of A (absorption). The general rate equation and the rate equation for reaction with mass transfer.

UNIT V

Fluid Fluid Reactors: Design of reactors for straight mass transfer and mass transfer plus not very slow reaction cases

Catalytic gas solid reactors: Design of single adiabatic fixed bed catalytic reactor

Text Books

1. Levenspiel O., “Chemical Reaction Engineering”, 3rdEdition, John Wiley & Sons, Singapore, (1999).
2. Fogler H. S., “Elements of Chemical Reaction Engineering”, 3rdEdition, Prentice Hall Inc., (1999)
3. Smith J. M., “Chemical Engineering Kinetics”, 3rdEdition, McGraw Hill, (1981).

Suggested References Books

1. Chemical and Catalytic Reaction Engineering, Carberry, J. J., Dover Books on Chemistry, 2001.
2. Chemical Reactor Analysis and Design Gilbert F. Froment, Kenneth B. Bischoff, Juray De Wilde, John Wiley & Sons, Incorporated, 2010

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18CH C17 **MASS TRANSFERS- II**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Principles of mass transfer operations to specific applications, separation and/or purification processes.
2. Theoretical/analytical aspects to design mass transfer equipments and to deal with complex problems of separations.
3. Suitable equipment required for various types of mass transfer operations.
4. Different types of Membrane process
5. Given industrial problem and apply concepts of mass transfer operations

Course outcomes: At the completion of this course, students able to

1. Understand the concept of different mass-transfer operations and their concerned equipment used in the chemical industries.
2. Interpret the importance and the role of liquid–liquid extraction and leaching in Separation Process
3. Articulate the process of adsorption and the equipment used in chemical industry
4. Calculate the enthalpies and interpret psychometric charts and design of cooling towers and drying equipment.
5. Distinguish among micro-filtration, ultra-filtration, nano-filtration, and reverse osmosis

UNIT – I: Introduction: Perspective on unified approach to operations.
Liquid – Liquid Extraction: Solubilities of ternary liquid systems. Triangular and solvent free coordinate systems. Choice of solvent. Extraction with insoluble and partially soluble systems – single stage, multistage cross-current and multistage counter-current extraction without reflux and Continuous contact extraction (packed beds). Equipment's for liquid – liquid extraction operation. Solid-Liquid Extraction:
Leaching: Preparation of solid, unsteady state operation, in-place leaching, heap leaching, percolation leaching, Shanks system, agitated vessels, percolation in closed vessels, Percolation Vs Agitation. Steady state continuous operation–equipment, methods of calculation of stage efficiency and practical equilibrium. Single stage leaching, multistage cross current leaching, multistage counter current leaching.

UNIT-II: Adsorption:
Principles of Adsorption and their applications – Types of adsorption – Adsorbents – Adsorption equilibrium – Adsorption Isotherms for vapor and dilute solutions. Single stage and multistage adsorption, Adsorption wave and breakthrough curve and fixed bed adsorption. Equipment for Adsorption operation, fixed bed adsorbers, break through . **Ion Exchange**: Principles of ion exchange, analogy between adsorption and ion exchange.

UNIT–III: Simultaneous Heat and Mass Transfer:
Humidification & Dehumidification: Vapour, gas mixtures – Humidity and relative saturation. Dew point adiabatic saturation and wet bulb temperatures – psychometric charts – Enthalpy of gas vapor mixtures. Humidification and Dehumidification techniques.
Design of Cooling Towers: Design calculations of cooling tower, Key points in the design of cooling tower step by step procedure of cooling tower.

UNIT-IV: Drying:
Equipments for Drying, moisture contents of solids – equilibrium, bound and unbound moisture. Design conditions – Rate of batch drying under constant drying conditions – Mechanism of batch drying – total time for batch drying.

UNIT-V: Membrane Process:
Types and choice of Membranes, Plate and Frame, tubular, spiral wound and hollow fiber Membrane Reactors and their relative merits, commercial, Pilot Plant and Laboratory Membrane permeators involving Dialysis, Reverse Osmosis, Nanofiltration, Ultra filtration and Micro filtration.

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Text Books

1. R.E.Treybal, Mass Transfer Operations, 3rd Edition, McGraw Hill, New Delhi, 1983
2. Binay K.Dutta, Principles of Mass Transfer and Separation Processes,2nd edition, Prentice Hall of India,2007

Suggested Readings:

1. C.J. Geankoplis, Transport Processes and Unit Operations, 3rd Edition, Prentice Hall, India, 1993

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18CH C 18 **PROCESS CONTROL**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Material and Energy Balance Calculations, Chemical Reaction Engineering - I

Course Objectives: To provide a conceptual and methodological framework to
1. Mathematical modeling based on transfer function approach for single loop systems
2. Feedback control of processes - concepts, terminology, methods, and performance
3. Obtain dynamic response of open loop and closed loop systems
4. Stability analysis in transient and frequency domains
5. Controller tuning methods and advanced control strategies

Course Outcomes: At the end of the course the student will be able to:
1. Characterize and analyze the dynamic behavior of linear systems (First and Second order)
2. Build block diagrams for simple chemical processes
3. Analyze stability, speed of response, frequency response, of simple feedback control systems
4. Analyze and tune process controllers
5. Empirically identify process dynamics

UNIT – I

Introduction: Need for control and automation, Laplace transforms, solution of ODEs using Laplace transform, Response of First order system, Transfer Function, Transient response to step, impulse, sinusoidal forcing function, physical examples of first order systems, liquid level, mixing process, concept of time constant, linearization, response of first order systems in series, interacting and non-interacting systems

UNIT – II

Response of Second Order Systems: Transient response of under damped, critically damped, over damped systems to step, impulse and sinusoidal forcing functions. Transportation lag

Control Systems: Negative and Positive feedback control systems, Servo and Regulatory control problems, Development of Block diagram, Controllers and final control elements, Ideal transfer functions of P, PI, PD and PID controllers

UNIT – III

Reduction of physical control systems to block diagrams, closed loop transfer functions for servo and regulator problems. Overall Transfer functions for multi loop control systems. Transient response of simple control systems for servo and regulator problems, measurement lags. Stability of a control system by Routh's Criterion

UNIT – IV

Root Locus: concept of root locus, plotting of the root locus diagram for feedback control systems, Transient response of control system from root locus plot.

Frequency response: Bode diagrams for first order, first order system in series, second order systems and for controllers and transportation lag. Bode stability criterion, Introduction to Nyquist stability criterion

UNIT – V

Advanced Control Strategies: Cascade Control, Feed Forward Control, Ratio control, Smith-predictor, IMC, MPC, dead-time compensation

Controller Tuning and Process Identification: ISE, ITAE, IAE, Ziegler – Nicholas and Cohen-Coon tuning methods, process identification by step testing

Text Books:

1. Donald R. Coughanowr , Steven E LeBlanc, "Process Systems Analysis and Control", 3rd edition, McGraw Hill Education (India) Edition 2013

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Suggested Reading:

1. George Stephanopoulos , "Chemical Process Control: An Introduction to Theory and Practice", Prentice-Hall of India, 1984
2. Peter Harriott , "Process Control", Tata McGraw – Hill Ltd.
3. Seborg, Edgar, Mellichamp and Doyle, "Process Dynamics and Control", 3rd Edition, Wiley India Pvt. Ltd., 2014

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18CH E07 **FLUIDIZATION ENGINEERING**
(Core Elective III)

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand:

1. Basic fundamentals of fluidization and fluidized bed behavior.
2. Minimum fluidization and pressure drop across the bed.
3. Various models to analyze the behavior and mixing patterns.
4. Heat and mass transfer aspects of fluidized bed.
5. Concepts of fluidized bed combustion chamber.

Course Outcomes: At the end of the course, the students will be able to:

1. Determine the minimum fluidization velocity and optimum operating fluidization velocity.
2. Design the fluidized bed in terms of pressure drop across the bed
3. Construct the distributors, TDH, height, diameter, power consumption of compressor for air.
4. Distinguish between boiler and furnaces, methods of starting up.
5. Estimate the amount of chemicals required to control the emission like SO_2.

UNIT – I: INTRODUCTION:
Processes involving contact between solid particles and a Fluid, Packed Beds, Fluidized Beds advantages and disadvantages of fluidized beds for industrial applications. Fundamental fluidized bed behavior, Fast fluidization, circulating fluidized beds. Particles and Fluidization: Physical properties of solid particles, size and shape, size range, surface area of particles in a bed, Bed voidage, classification of particles according to Fluidization characteristics, pressure drop across packed beds, minimum fluidization velocity and its determination.

UNIT – II: TWO – PHASE THEORY OF FLUIDIZATION:
Bubbles and Fluidization Regimes, Bubble rise velocity, Bed expansion, Bubble growth and slugging, Mixing, Elutriation and Transport of solids, General mechanism of mixing of particles, mixing and segregation of particles, Terminal velocity of particles, Elutriation, transport disengaging height, solids transport. Davidson's Model, Diffusion model, Bubbling bed model ideal mixing stage model, two regime models.

UNIT – III: FLUIDIZED BED HEAT TRANSFER:
Heat Transfer in Beds of Particles, Gas -to- particle heat transfer, Bed – to- surface heat transfer, particle convection component, interphase gas connective component, Radioactive component, Estimation of Bed–to surface Heat Transfer coefficient, Heat Transfer between the Bed-Distributor, side walls, immersed tubes or components, Heat Transfer to surfaces located above the Bed, Free surface.

UNIT IV: DESIGN OF SIMPLE FLUIDIZED BEDS:
Introduction, Estimation of Bed Dimensions and Fluidizing velocity, Transport disengaging Height, Distributors, Heat removal from fluidized beds from cooling tubes in the bed, optimum size of a fluidized bed reactor. Power consumption.

UNIT – V: FLUIDIZED BED COMBUSTION:
Introduction, combustion systems for solid fuels combustors and the first law of thermodynamics, fluidized Bed combustion of solid fuels size of fluidized bed combustion system, size of inert particles in the bed, turndown efficiency of fluidized bed combustion, Equipment, combustion of fuel particles in a fluidized bed, Distinguish between boiler and furnaces, methods of starting up, circulating or fast fluidized bed combustion systems, control of emission of SOx ,CO and CO2

Text Books:

1 . J.R. Howard Adam Hilger, "Fluidized Bed Technology -Principles & Applications", IOP, Pub Ltd., NY. 1989.

Suggested Readings:

1. Diazo Kuni & Octave Levenspiel, "Fluidization Engineering", 2nd Edition, John Wiley and Sons, 2002.
2. John M. Matsen, Grace John R , "Fluidization", Springer-Verlag New York Inc., 1980.

18CH E 08 **PETROCHEMICAL TECHNOLOGIES**

(Core Elective III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives: This course helps the students to understand the
1. Petroleum refineries worldwide.
2. Extraction and production of oil and gas to meet energy needs.
3. Importance of refining crude oil for a wide spectrum of useful products such as petrochemicals, plastics.

Course Outcomes: At the end of the course, the students will be able to
1. Explain the composition, applications and formation theories of crude
2. Summarize the refining process of crude oil.
3. Classify Ethylene derivatives and summarize their manufacturing processes.
4. Outline Propylene and C_4 derivatives and explain their manufacture processes.
5. Classify higher paraffin derivatives and outline manufacturing processes.
6. Identify Aromatic derivatives sources and separation methods for aromatics.

UNIT–I

Origin and formation of petroleum:- Organic theories, Inorganic theories and biological methods for explaining the formation of Crude oil. **Definition of refining terms :-** API Gravity, Aniline point, Octane number, Cetane number, Smoke point, Fire point, Flash point, Diesel Index, Naphtha, Types of Naphtha etc. Composition and applications of crude oil. **Petroleum Refining: -** Overall refining of crude petroleum. Production of gasoline, kerosene and lubricating oils.

UNIT– II

Rebuilding of Hydrocarbons and techniques involved: **Naphtha cracking:** Definition, types, reactions, fluidized bed cracking, description of the reactors. **Alkylation:-** Hydrofluoric acid process and sulphuric acid process **Isomerization:-** Aluminum chloride process and isomerization with platinum catalyst. **Polymerization:** - Types of polymerizations,

mechanism of polymerization, polymerization in presence of sulphuric acid, polymerizations in presence of phosphoric acid.

UNIT– III

Ethylene Derivatives: - various products with ethylene as the starting materials. **Manufacturing of the following:-** Vinyl Chloride Monomer, Perchloroethylene – pyrolysis of carbon tetra chloride, chlorination and pyrolysis method, Ethyl alcohol by direct hydration and liquid phase hydration methods, Vinyl acetate monomer, Ethylene oxide and its applications , Polyethylene, Styrene.

UNIT – IV

Propylene derivatives: - list of propylene derivatives. **Manufacturing of the following:-** Isopropyl alcohol, Acetone by catalytic dehydrogenation, Propylene oxide, Glycerine by Acrolein, allyl chloride and by isomerization of propylene oxide methods. **Derivatives of C_4 Hydrocarbons:** List of butadiene derivatives, Manufacturing of butadiene from n-butylene and by oxidative dehydrogenation. Purification of butadiene

UNIT –V

Derivative of Higher Paraffins: Manufacturing of Isoprene, olefins of C5 , C6,long chain and straight chain Olefins.

Derivatives of Aromatics: - Sources of aromatic compounds, production of aromatics. Effect of temperature, pressure and catalyst on dehydrogenation process. Separation of aromatics from Non-aromatics and separation of aromatics into individual streams

Text Books:

1. W.L.Nelson, "Petroleum refinery engineering" 4th ed., McGraw Hill company, 2013.
2. B.K.Bhasker Rao, "Modern petroleum refining process", 5th ed., Oxford and IBH, 2008.

Suggested Reading

1. N.K.Sinha, "Petroleum Refining and Petro Chemicals", 1st edition, Umesh publications , 2003.
2. Kirk-Othmer, "Encyclopedia of Chemical Technology", 3rd Ed..John Wiley and sons.Inc, 2004.
3. Meyers Robert, "Hand Book of Petroleum Refining Processes", 3rd edition McGraw Hill, 2003

18CH E 09 **BIOCHEMICAL ENGINEERING**
(Core Elective III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to

1. understand the functions of living cells
2. apply the principles of Chemical Engineering to bioprocesses.
3. conduct analysis on the biological factors that are important in the design, operation, performance and/or monitoring of a biological process
4. understand the significance of microbes and enzymes
5. understand the applications of different bio processes

Course Outcomes: On successful completion of this module, students should be able to

1. Describe the basic structure and function of cells & relate cell function to products and processes useful to man
2. Explain classification, growth concepts and various types of interactions in microbes
3. Illustrate the significance of enzymes as biocatalysts and immobilized enzymes.
4. Identify and explain the basic features of bioreactors
5. Describe the principles of the various separation procedures involved in the downstream processing of products
6. Summarize the principles of Fermentation technology and products from Industrial biotechnology

UNIT – I Introduction to Biochemical Engineering, Molecular Biology& Bio Chemistry
Biochemical Engineering Principles, Biophysics and cell doctrine: Atomic Theory and Cell Theory, Important cell types, structure and functions of a typical cell and their components, Transport across cell membranes: Passive and facilitated diffusion, Active transport Structure and functions of Bio Molecules: Carbohydrates, lipids, Nucleotides to Nucleic Acids – RNA and DNA, Amino acids to Proteins - the building blocks of biochemical life Biosynthesis and Metabolic Pathways: Biosynthesis of Small and Macro Molecules Introduction of metabolic pathways and end products of glucose metabolism.

UNIT – II Introductory Microbiology
Introduction to Microbiology: Classification and Industrial uses of Microorganisms Growth and Reproduction of Microbes: Growth cycle phases for batch cultivation. Monod's growth kinetics – Growth Rate dependant classification of Microorganisms.
Microbial Genetics: Recombinant DNA technology and mutant populations. Multiple Interacting Microbial populations: Neutralism, Mutualism, Commensalism, Amesanalism, Predatism and Parasitism

UNIT – III Enzyme Technology
Enzymology: Enzymes as Biocatalysts - The enzyme substrate complex and enzyme action and Classification of Enzymes based on Functions.
Kinetics of Enzyme Catalyzed Reactions: Simple enzyme kinetics with one and two substrates. Determination of rate constants, substrate activation and inhibition, modulation and regulation of enzyme activity / effect of PH and temp on enzyme activity.
Immobilized Enzyme Technology: Types of Enzyme immobilization, Immobilized enzymes in industrial processes,
Cofactors, Apo-enzymes and Coenzymes utilization and regeneration

UNIT – IV Bioreactors and Down Stream Techniques - Introduction
Design and Analysis of Biological Reactors: Batch and Continuous Stirred Tank Reactors, Enzyme reactors Ideal
Reactors for kinetic measurements: The ideal batch reactor / The ideal continuous flow stirred tank reactor - Alternate bio-reactor configurations
Separation Processes: Filtration, Centrifugation, Adsorption, Reverse osmosis, Dialysis, Electrophoresis, Sedimentation and Extraction Purification Processes: Precipitation, Crystallization, and Chromatography

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UNIT – V Bioprocess Technology

Fermentation Technology: Types of Fermentation, Medium formulation and Culture Propagation, Environmental Biotechnology: Effluent treatment.

Industrial Biotechnology: Commercial enzymes, Antibiotics and single cell protein

Text Books:

1. James, E Bailey and David F Ollis, "Biochemical Engineering fundamentals", 2nd Edition, McGraw-Hill Internal Edition.1986
2. Prof. Shigeo Katoh, Prof. Fumitake Yoshida, "Biochemical Engineering: A Textbook for Engineers, Chemists and Biologists", First Edition, Wiley-VCH Verlag GmbH & Co. 2010

Suggested Reading:

1. Michael L Shuler and Fikret Kargi, "Bioprocess Engineering: Basic Concepts". Second Edition Prentice Hall, 2002

18CH E10 **SUGAR TECHNOLOGY**

(Core Elective IV)

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand**:**

1. The performance measures of different types of unit operations in sugar processing.
2. Applications, advantages and limitations of the processing procedure.
3. The competence and optimization of advanced technology in sugar processing.
4. The possible by-products of any sugar industry and production of saleable derivatives.

Course Outcomes: At the end of the course, the student able to:

1. Apply Principles and skills of work in sugar cane milling, processing and refining in practical settings.
2. Determine the composition of different types of sugars by volumetric and gravimetric methods.
3. Explain the unit operations for effective processing of cane juice, Batch and continuous methods
4. Identify the concepts of quality assurance and control in industry as per Indian regulations and practices.
5. Summarize the methods to reclaim by-products.

UNIT - I

Importance of sugar industry. Different raw materials for sugar manufacturing, composition of raw materials, history, origin and distribution of sugarcane, production and productivity of sugarcane in India. Indian sugar industry on global screen. Manufacturing processes of raw sugar and crystalline white sugar. Reducing sugars - composition, volumetric and gravimetric determination methods.

UNIT - II

Conveying of raw materials - cane carrier and feeding table working principles. Cane preparation – objective, sieving, preparation index, cane knives, crushing and shredding applications. Extraction of cane juice by milling operation - basic concept of roller mills, working principles, conditions for good milling operation, milling efficiency, maceration and imbibitions – importance, effect, method, objective and efficiency. Cane juice clarification – simple, compound and neutral defaction procedures. Sulphitation and carbonation - batch and continuous methods. Single and double carbonation process, De-Hans‟ process, comparison of different clarification modern techniques.

UNIT - III

Juice heaters - construction and working principles. Juice filtration - plate and frame filter presses, RVDF, types of filter cake washing. Evaporation- multiple effect evaporators - construction and operation. Steam economy and capacity. Vacuum pan boiling - construction, types of pans, speed of circulation, heating surface to volume ratio, pan boiling techniques, different boiling schemes.

UNIT - IV

Crystallization – nucleation, graining methods, advantages and disadvantages of graining. Theory of crystallization, crystallization zone, crystal growth. centrifuge –construction & working, factors influences on time of curing. Advantages and disadvantages of batch / continuous centrifugal machine. Separation of molasses-different molasses conditioning methods, precautions during molasses conditioning. Sugar drying - various aspects regarding drying and cooling, rotary dryer. Packing of sugar -types of sugar grader, dilution indicator, quality and safety factors, location and stalking of sugar bags.

UNIT - V

Sugar by-products: bagasse, press mud and molasses- their composition and applications. Production of bio-gas, fiber board, furfural filter mud, extraction of cane wax, manure, industrial alcohol and rectified spirit. Sugar scales and normal weight.

Text Books:

1. Meade and Chen, “Hand of book of cane sugar”, 11th Ed, Wiley Inter science, New York, 2001.
2. James C.P Chen, “Cane Sugar Hand book”, 12th Ed, Elsevier Pub. Co., New York, 1993.

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Suggested Readings:

1. R B L Mathur, Hand Book of Cane Sugar Technology", 2nd Ed, Oxford & IBH, 1978. 2. 2.John H. Payne, "Unit operation in cane sugar production", Sugar series book 4, Elsevier Pub. Co., New York, 1982.

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18CH E11 **PULP AND PAPER TECHNOLOGY**
(Core Elective IV)

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the
1. Basic concepts of Pulp and Paper making processes.
2. Overview of pulping process.
3. Details of physical and chemical characteristics of fibrous raw materials and black liquor.
4. Various types of cooking and bleaching methodologies.
5. Recovery of energy and chemicals used in pulping processes with due techno-economic and environmental considerations.

Course Outcomes: At the completion of this course, the students able to:
1. Design the operation, maintenance and safety aspects for paper making.
2. Identify grade paper and boards based on different testing methods.
3. Select appropriate bleaching technique for required paper quality.
4. Differentiate the important wood and fibre properties that affect paper quality.
5. Identify, formulate and solve design problems pertaining to pulp digesters.

UNIT – I: Introduction
Importance of Paper, Definitions of Pulps
Wood Parts & Types: Ultra structure of Cell Wall, Wood cell types, Early & Latewood, Softwoods, Hard woods & Non-woods. Comparison of different raw materials.
Distribution of Wood Constituents – Cellulose, Hemi-cellulose, Lignin, Extractives and Inorganic components.

UNIT – II: Overview of pulping process
Mechanical Pulping: Pressurized ground pulping, Refiner Pulping, Chemo (thermo) mechanical pulping processes.
Kraft Pulping: Description of Kraft Cooking Process, Kraft recovery, Composition & Analysis of white liquor, Chemical reactions & process variables. Pulp yield, End uses of kraft pulps.

UNIT – III: Pulp and black liquor characterization
Pulp testing methods - Kappa number, water retention value, CED viscosity, drainability, beater evaluation, zero span tensile strength.
Black liquor characterization - Chemical properties, viscosity and rheological behavior at different concentrations, thermal properties, calorific value, thermal conductivity, specific heat, black liquor oxidation, desilication and concentration of black liquor.

UNIT IV: Bleaching operations
Objectives of bleaching – Elemental chlorine free and total chlorine free bleaching; Bleachability and its measurement, bleaching reactions, reaction kinetics and operating variables for different bleaching agents like ClO_2, O_2, O_3, hypochlorite, H_2O_2.
Stages of bleaching – Oxygen delignification, Chlorination, Extraction, Hypochlorite bleaching, Ozone bleaching, Peroxide bleaching, Operating variables for different bleaching stages; ECF and TCF bleaching systems for chemical pulps; bleaching systems for mechanical and high yield pulps.

UNIT – V: Paper Making and its Properties
Paper Testing Methods – Flow sheet of complete pulp and paper making process, Strength properties, Surface properties, Optical properties & Absorption properties. Different grades of paper, boards & newsprint specifications; BIS and ISO standards of paper. Paper properties dependence on paper making processes, Calibration of instruments. Paper recycling process, Effluent treatment processes with environmental considerations.

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Text Books:

1. Kenneth W. Britt, “Handbook of Pulp & Paper Technology”, 2nd Edition, Reinhold Publishing Corporation, 2004.
2. G. A Smook., “Handbook for Pulp & Paper Technologists”, 3rd Edition, Angus Wilde Publications, 2003.

Suggested Readings:

1 .Hakan Karlsson, “Fiber Guide-Fiber analysis and process applications in the pulp & paper industry”, Ab Lorentzen & Wetre, 1st Edition, 2006.

2. EIRI Board ., “Handbook of Pulp & Paper, Paper board and Paper based Technology”, Engineers India Research Institute, 2nd Edition, 2015 .

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18CH E 12 **FOOD TECHNOLOGY**

(Core Elective IV)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives: This course helps the students to understand the

1. Basic food preparation techniques. Food quality.
2. Physical, chemical, and/or microbiological changes in food and mechanical manipulation.
3. Learn fundamentals of modifying food to meet current nutrition recommendations
4. Learn to find credible sources of information re. food science and nutrition.
5. Food processing Applications and Packaging

Course Outcomes: At the end of the course, student will be able to
1. Explain techniques in food processing
2. Design process equipment to achieve the desired quality of food.
3. Develop novel food processes that have a minimal effect on food quality
4. Select control strategies to maintain food quality.
5. Apply the scientific method to food science problems.

UNIT – I

Introduction: General aspects of food industry, World food demand and Indian scenario, Constituents of food, Quality and nutritive aspects, Product and Process development, engineering challenges in the Food Processing Industry.

UNIT – II

Basic principles: Properties of foods and processing theory, Heat transfer, Effect of heat on micro-organisms, Basic Food Biochemistry and Microbiology: Food Constituents; Food fortification, Water activity, Effects of processing on sensory characteristics of foods, Effects of processing on nutritional properties, Food safety, good manufacturing practice and quality Process Control in Food Processing.

UNIT – III

Ambient Temperature Processing: Raw material preparation, Size reduction, Mixing and forming, Separation and concentration of food components, Centrifugation, Membrane concentration, Fermentation and enzyme technology, Irradiation, Effect on micro-organisms, Processing using electric fields, high hydrostatic pressure, light or ultrasound.

UNIT – IV

Heat processing using steam, water and air: Blanching, Pasteurization, Heat sterilization, Evaporation and distillation, Extrusion, Dehydration, Baking and roasting, Heat processing by direct and radiated energy: Dielectric heating, Ohmic heating, Infrared heating, Gamma irradiation.

UNIT – V

Post Processing Applications Packaging: Coating or enrobing, Theory and Types of packaging materials, Printing, Interactions between packaging and foods, Environmental considerations.

Text Books:

1. Fellows P., Food Processing Technology: Principles and Practice, Wood head Publishing, 4th Edition, 2016.
2. Toledo R, Fundamentals of Food Process Engineering, Springer, 3rd Edition, 2010.

Suggested Readings:

1. Singh R.P. & Heldman D.R., Introduction to Food Engineering, Academic Press, 3rd Edition, 2001.

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18EEO 05 **WASTE MANAGEMENT**
(Open Elective I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To Imbibe the concept of effective utilization of any scrap
2. To become familiar with the processes of all disciplines of engineering.
3. To learn the technique of connectivity from waste to utility.

Course Outcomes:
1. Understand the various processes involved in allied disciplines of engineering
2. Infer the regulations of governance in managing the waste
3. Distinguish the nature of waste materials concerned to the particular branch of engineering
4. Explore the ways and means of disposal of waste material
5. Identify the remedies for the disposal of a selected hazardous waste material

UNIT-I
Introduction to waste management: Relevant Regulations Municipal solid waste (management and handling) rules; hazardous waste (management and handling) rules; biomedical waste handling rules; fly ash rules; recycled plastics usage rules; batteries (management and handling) rules. Municipal Solid Waste Management – Fundamentals Sources; composition; generation rates; collection of waste; separation, transfer and transport of waste; treatment and disposal options.

UNIT-II
Hazardous Waste Management : Fundamentals Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects, Radioactive Waste Management – Fundamentals Sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options.

UNI-III
Environmental Risk Assessment: Defining risk and environmental risk; methods of risk assessment; case studies, Physicochemical Treatment of Solid and Hazardous Waste Chemical treatment processes for MSW (combustion, stabilization and solidification of hazardous wastes); physicochemical processes for hazardous wastes (soil vapor extraction, air stripping, chemical oxidation); ground water contamination and remediation

UNIT-IV
Biological Treatment: Solid and Hazardous Waste Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation.

UNIT-V
Landfill design aspects: Landfill design for solid and hazardous wastes; leachate collection and removal; landfill covers; incineration

Text Books:
1. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D.Buckingham,P.L. and Evans, J.C. Hazardous Waste Management, McGraw Hill International Editions, New York, 1994
3. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York, 1997

Suggested Reading:
1. Basics of Solid and Hazardous Waste Mgmt. Tech. by Kanti L.Shah 1999, Prentice Hall.
2. Solid and Hazardous Waste Management 2007 by S.C.Bhatia Atlantic Publishers & Dist.

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18ME O04 **ENTREPRENEURSHIP**

(Open Elective I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. Concept and procedure of idea generation.
2. The nature of industry and related opportunities and challenges.
3. Elements of business plan and its procedure.
4. Project management and its techniques.
5. Behavioral issues and Time management.

Outcomes: At the end of the course, the students are able to

1. Understand the concept and essence of entrepreneurship. (BL-2)
2. Identify business opportunities and nature of enterprise. (BL-3)
3. Analyze the feasibility of new business plan. (BL-4)
4. Apply project management techniques like PERT and CPM for effective planning and execution of Projects (BL-3)
5. Use behavioral, leadership and time management aspects in entrepreneurial journey (BL-3)

UNIT-I

Entrepreneurship: Definition, functions of entrepreneurship, qualities of entrepreneurs, identification and characteristics of entrepreneurs, entrepreneur vs. intrapreneur, first generation entrepreneurs, women entrepreneurs, conception and evaluation of ideas and their sources.

UNIT-II

Indian industrial environment: Competence, opportunities and challenges, entrepreneurship and economic growth, small scale industry in India, objectives, linkage among small, medium and heavy industries, types of enterprises, corporate social responsibility.

UNIT-III

Business plan: Introduction, elements of business plan and its salient features, business model canvas, technical analysis, profitability and financial analysis, marketing analysis, feasibility studies, executive summary, selection of technology and collaborative interactions.

UNIT-IV

Project management: During construction phase, project organization, project planning and control using CPM, PERT techniques, human aspects of project management, assessment of tax burden.

UNIT-V

Behavioral aspects of entrepreneurs: Personality, determinants, attributes and models, leadership concepts and models, values and attitudes, motivation aspects, time management: approaches of time management, their strengths and weaknesses. time management matrix and the urgency addiction .

Text Books:

1. Vasant Desai, “Dynamics of Entrepreneurial Development and Management”, Himalaya Publishing House, 1997.
2. Prasanna Chandra, “Project-Planning, Analysis, Selection, Implementation and Review”, Tata Mcgraw-Hill Publishing Company Ltd.1995.
3. S.S. Khanka, “Entrepreneurial Development”, S. Chand & Co. Pvt. Ltd., New Delhi,2015.

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, “Entrepreneurship”, 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, “First Things First”, Simon and Schuster Publication,1994.

18ME O06 **NANO MATERIALS AND TECHNOLOGY**

(Open Elective I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. Nanotechnology approach and challenges.
2. Materials and characterization procedures.
3. Zero and one dimensional nanostructures.
4. Various fabrication techniques.
5. Special nano materials and nano biomaterials.

Outcomes: At the end of the course, the students are able to

1. Understand the basic concepts, developments and challenges in nanotechnology. (BL-2)
2. Describe the methods of evaluating magnetic and electronic properties, microstructure by SPM and atomic force microscopy. (BL-2)
3. Apply heterogeneous methods and characterization techniques of zero & one dimensional nanostructure (BL-3)
4. Evaluate various nano material fabrication techniques. (BL-5)
5. Analyze nano materials and nano biomaterials for obtaining solutions to societal problems. (BL-4)

UNIT - I

Introduction: Nanoscale, properties at nanoscale, advantages and disadvantages, importance of nanotechnology, bottom-up and top-down approaches, challenges in nanotechnology.

UNIT - II

Materials of Nanotechnology: Introduction, Si-based materials, Ge-based materials, ferroelectric materials, polymer materials, GaAs &InP (HI-V) group materials, nano tribology and materials, characterization using scanning Probe microscope, AFM.

UNIT - III

Nano structures: Zero dimensional nanostructure, synthesis procedure by heterogeneous method, characterization techniques, properties and applications of nano particles

One dimensional nanostructures: Synthesis procedure, characterization procedure and principles involved, properties and applications of nanowires .

UNIT - IV

Nano fabrication: Introduction, basic fabrication techniques by lithography and doping, MEMS fabrication techniques, nano fabrication techniques by E-beam, nano-imprint fabrication, epitaxy and strain engineering.

UNIT - V

Special nano materials: Introduction, synthesis procedure by metal-polymer, characterization procedures, applications.

Nano biomaterials: Introduction, biocompatibility, anti-bacterial activity, applications.

Text Books:

1. Dieter Vollath, “Nanomaterials: An introduction to Synthesis, properties and applications”, Wiley,2013.
2. GuozhongCao,“NanostructuresandNanoMaterials,Synthesispropertiesandapplications”,ImperialCollege Press,2004.
3. Carl C Koch, “Nano materials Synthesis, Properties and applications”, Jaico Publishing House,2008.

Suggested Reading:

1. Willia Tllsey Atkinson, “Nano Technology”, Jaico Publishing House,2009.
2. George W. Hanson, “Fundamentals of Nanoelectronics”, Pearson Education,2009.

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18ME O07 **INTELLECTUAL PROPERTY RIGHTS**

(Open Elective I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. Fundamental aspects of IP.
2. Salient features of IPR acts.
3. The methods of registrations of Intellectual property.
4. Awareness for innovation and its importance of protection.
5. The changes in IPR culture and techno-business aspects of IPR.

Outcomes: At the end of the course, the students are able to

1. Understand the evolution of IP, working of organization's at global level to protect and promote IP (BL-2)
2. Familiarize with the patent filing process at national and international level. (BL-2)
3. Draw the logical conclusion of research, innovation and patent filing. (BL-3)
4. Compare different kinds of IP and their patenting system. (BL-4)
5. Understand the techno-legal-business angle of IP, infringement and enforcement mechanisms for protection. (BL2)

UNIT I

Introduction: Definition of intellectual property, the need for intellectual property rights (IPR), kinds of intellectual property rights, IPR in India – genesis and development, IPR abroad, importance of WTO, TRIPS agreement, patent cooperation treaty, Berne and universal copyright conventions.

UNIT-II

Patents: Definition of patent, commercial significance , term of patent, patentable subject- matter, rights and obligations of patentee, searching of existing patents, drafting of patent, specification of patent, filing of a patent, the different layers of the patent system (national, regional and international options), compulsory licensing and licenses of rights, revocation of patents, differences between utility model and patent.

UNIT-III

Industrial designs: Definition of designs, registration of design, rights and duties of proprietor of design, piracy of registered design.

Trademarks: Meaning of trademarks, purpose of protecting trademarks, registration of trademarks, passing off, assignment and licensing of trademarks, infringement of trademarks.

Geographical indications: Definition, differences between GI and trademarks.

UNIT-IV

Copy right: Nature and scope of copy right, term of copyright, subject matter of copyright, rights conferred by copyright ,publication, broad casting, telecasting, computer program, database protection, assignment and transmission of copyright, infringement of copy right trade secrets and know-how agreement.

UNIT-V

Enforcement of intellectual property rights: Infringement of intellectual property rights, enforcement measures, emerging issues in intellectual property protection, case studies of patents and IP Protection.

Unfair competition: What is unfair competition, relationship between unfair competition and intellectual property law

Text Books:

1. Ajit Parulekar and Sarita D"Souza, "Indian Patents Law-Legal& Business Implications ",Macmillan India Ltd., 2006.
2. B.L.Wadehra, "Law relating to Patents, Trade Marks, Copyright, Designs &Geographical Indications", Universal law Publishing Pvt Ltd., India, 2000.
3. P. Narayanan, "Law of Copyright and Industrial Designs"; Eastern law House, New Delhi,2010.

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Suggested readings:

1. Cronish W.R, "Intellectual Property Patents, Copyright, Trade Marks and Allied rights", Sweet Maxwell,1993.
2. P. Narayanan, "Intellectual Property Law" Eastern Law Edn., 1997.

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18CSO 09 **BASICS OF ARTIFICIAL INTELLIGENCE**
(Open Elective I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basic Mathematics.

Course Objectives: The main objectives of this course are:

1. To Provide fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Identify various search strategies to solve problems.
2. Compare and contrast knowledge representation schemes.
3. Apply Bayesian Networks and Dempster Shafer theory for reasoning.
4. Explain the role of agents and interaction with the environment.
5. Determine different learning paradigms.
6. Explain robotic architectures and expert systems.

UNIT - I

Introduction: Definition, history, applications. Problem Solving: AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate–and–test, Hill Climbing, Constraint Satisfaction.

UNIT - II

Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification. Knowledge Representation (Structured): Declarative representation, Semantic nets, procedural representation, frames.

UNIT - III

Reasoning: Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory. Planning: Components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT - IV

Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: Decision tree. Intelligent Agents: Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - V

Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition. Perception and Action: Real Time Search, Vision, Speech Recognition, ACTION: Navigation, Manipulation, Robot architectures.

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, “Artificial Intelligence”, 3rd Edition, 2008
2. Russell Norvig, “Artificial Intelligence-Modern Approach”, 3rd edition, 2010.

Suggested Reading:

1. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2012.
2. Nelson M. Mattos, “An Approach to Knowledge Base Management”, Springer Berlin Heidelberg, 1991.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

18CH C 19 **CHEMICAL ENGINEERING LAB II A (CHEMICAL REACTION ENGINEERING)**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

List of Experiments

Chemical Reaction Engineering

1. Studies in Batch Reactor: To find the Arrhenius form of temperature dependency of reaction
2. Studies in Mixed Flow Reactor (CSTR) : To find kinetics from reactor performance of CSTR
3. Studies in Tubular Reactor: To determine the rate constant and to verify the order of reaction
4. Mass Transfer with Chemical Reaction: (Liquid – Liquid Reaction System) To find out the mass transfer coefficient in a stirred cell: With chemical reaction and without chemical reaction
5 Mass Transfer with Chemical Reaction: (solid – Liquid Reaction System) To find the mass transfer coefficient without chemical reaction and with chemical reaction.
6. R.T D Studies in Packed bed reactor: To determine the axial mixing (axial dispersion) in the packed column.
7. R T D Studies in Tubular Column To determine the variance of residence time distribution and the dispersion number in a tubular column.
8. Studies in Batch Reactor: With Equimolar Feed (M = 1) : To determine the rate constant and to verify the order of reaction by differential & integral methods of analysis.
9. Studies in Batch Adiabatic Reactor: to determine the kinetics of an exothermic reaction from the Temperature of the reaction system.
10. Studies in Mixed Flow Reactors in series: To compare the actual & ideal performances of a Reaction system.
11. Studies in Packed bed: To determine the rate constant and to verify the order of reaction from performance of the reactor.

Text Book

1. Octave Levenspiel, Chemical reaction Engineering, 3rd Ed, Wiley India Pvt.Ltd, New Delhi, 2006

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18CH C 20

CHEMIAL ENGINEERING LAB II B
(MASS TRANSFER OPERATIONS & THERMODYNAMICS)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

List of Experiments

Mass Transfer Operations

1. Estimation of diffusivity coefficient for the gaseous system (CCl4 - Air)
2. Estimation of the mass - transfer coefficient k_G for Air- Water system and plotting the variation of k_G with Reynolds‟s number.
3. Determination of vapour - liquid equilibrium data for the given system.
4. Verification of the Rayleigh`s equation for the system of methanol and water
5. Determination of the capacity coefficient of the packed column under total reflux conditions and calculation of height equivalent to theoretical plate.
6. Developing the drying curve by using tray drier and estimation and composition of time required for drying the given solid.

Thermodynamics

1. Determine the PVT behaviour of pure fluids by using Equation of state Liquid- Liquid Equilibrium Equipment
2. Calculate the property change of mixing
3. To determine the relationship between vapour and liquid at different temperatures
4. To determine the solubility characteristics of given solution at different temperatures

Text Books

1. R.E.Treybal, Mass Transfer Operations, 3rd Edition, McGraw Hill, New Delhi, 1983
2. Introduction to Chemical Engineering Thermodynamics (in SI units) by J M Smith and H C Van Ness and M M Abbott, 7th edition, Mc-Graw Hill International Edition, 2005

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
Choice Based Credit System (with effect from 2019-20)
B.TECH (Chemical Engineering)

SEMESTER – VII

S. No.	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16CH C 24	Mass Transfer Operations –II	3	-	3	30	70	3
2	16CH C 25	Petrochemical Engineering	3	-	3	30	70	3
3	16CH C 26	Process Equipment Design	3	-	3	30	70	3
4	16CH C 27	Transport Phenomena	3	-	3	30	70	3
5		Core Elective-V	3	-	3	30	70	3
6		Open Elective-I	3	-	3	30	70	3
PRACTICALS								
7	16CH C 28	Equipment Design and Drawing Lab	-	3	3	25	50	2
8	16CH C 29	Mass Transfer Operations Lab	-	3	3	25	50	2
9	16CH C 30	Seminar	-	3	-	50	-	2
TOTAL			**18**	**9**	**-**	**280**	**520**	**24**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Core Elective-V	
16CH E 11	Polymer Technology
16CH E 12	Pulp and Paper Technology
16CH E 13	Pollution Control in Process Industries

Open Elective-I	
16CE O 02	Disaster Mitigation and Management
16ME O 01	Entrepreneurship
16ME O 04	Intellectual Property Rights
16EG O 01	Technical Writing Skills

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16CH C 24

MASS TRANSFER OPERATIONS – II

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the

1. Distillations methods - batch, semi continuous, continuous distillation for binary miscible systems.
2. Various methods to design distillation columns.
3. Concepts of solvent extraction methods using Triangular diagrams for ternary systems and binary immiscible system along with design.
4. Concepts of various leaching methods and leaching equilibriums with design.
5. Concepts of Absorption, Adsorption equilibrium / Isotherms and design.

Course Outcomes: At the end of the course, the students will be able to

1. Differentiate the application of various types of distillation processes.
2. Design and estimate the number of theoretical stages of distillation column using McCabe- Thiele method and Ponchan-Savarit method.
3. Design and estimate the number of theoretical stages for Liquid-Liquid extraction.
4. Design and estimate the number of theoretical stages for Solid-Liquid extraction.
5. Design and estimate the number of theoretical stages for Adsorber.

UNIT- I: Distillation

VLE Phase diagrams – Tie lines and mixture rule – Flash vaporization and differential distillation for binary mixtures – Steam distillation. Batch distillation with reflux for binary mixtures.

UNIT-II: Continuous fractionation

Continuous fractionation of binary mixtures, Ponchan – Savarit method, McCabe – Thiele method for determination of ideal plates for binary mixtures, Optimum reflux ratio, Use of total and partial condensers. Use of open steam. Packed bed distillation. Principles of Azeotropic and Extractive distillation.

UNIT–III: Liquid – Liquid Extraction

Solubilities of ternary liquid systems. Triangular and solvent free coordinate systems. Choice of solvent. Extraction with insoluble and partially soluble systems – single stage, multistage cross-current and multistage counter-current extraction without reflux and Continuous contact extraction (packed beds). Equipments for liquid – liquid extraction operation.

UNIT–IV: Leaching

Preparation of solid, Unsteady state operation, in-place leaching, heap leaching, percolation leaching, Shanks system, agitated vessels, percolation in closed vessels, Percolation Vs Agitation. Steady state continuous operation–equipment-methods of calculation, stage efficiency and practical equilibrium. Single stage leaching, multistage cross current leaching, multistage counter current leaching.

UNIT-V: Adsorption

Principles of Adsorption and their applications – Types of adsorption – Adsorbents – Adsorption equilibrium – Adsorption Isotherms for vapor and dilute solutions. Single stage and multistage adsorption, Adsorption wave and breakthrough curve and fixed bed adsorption. Equipment for Adsorption operation.

Text Books:

1. R.E.Treybal, "Mass Transfer Operations", 3rd Edition, McGraw Hill Book Company, 2002.
2. Geankoplis, "Transport Processes and Separation Processes Principles", 4th Edition, Prentice Hall, 2003.

Suggested Readings:

1. Richardson and Coulson, "Chemical Engineering", Volume 1, Tata McGraw Hill Publications, 2000
2. Binay.K. Dutta, "Principles of Mass Transfer & Separation Processes", Eastern Economy Edition, PHI learning Pvt, ltd, 2015.
3. Warren McCabe and Julian Smith and Peter Harriott, "Unit Operations of Chemical Engineering", 7 th ed., McGraw Hill Book Company, 2005.

16CH C 25

PETRO CHEMICAL ENGINEERING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the

1. Petroleum refinery worldwide.
2. Extraction and production of oil and gas to meet energy needs.
3. Importance of refining crude oil for a wide spectrum of useful products such as petrochemicals, plastics.
4. Manufacturing of Propylene derivatives
5. Manufacturing of higher Hydrocarbons

Course Outcomes: At the end of the course, the students will be able to

1. Grade the crude oil, its composition and applications based on formation theories.
2. Know refining process of crude oil.
3. Apply the techniques of catalytic and non-catalytic cracking methods.
4. Design the manufacture of derivative products.
5. Design the safety and pollution control techniques in petroleum refining industries.

UNIT-I

Origin and formation of petroleum: Organic theories, Inorganic theories and biological methods for explaining the formation of Crude oil. Definition of refining terms - API Gravity, Aniline point, Octane number, Cetane number, Smoke point, Fire point, Flash point, Diesel Index, Naphtha, Types of Naphtha etc. Composition and applications of crude oil. Petroleum Refining - Overall refining of crude petroleum. Production of gasoline, kerosene and lubricating oils.

UNIT-II

Rebuilding of Hydrocarbons and techniques involved: Naphtha cracking: Definition, types, reactions, fluidized bed cracking, description of the reactors. Alkylation - Hydrofluoric acid process and sulphuric acid process Isomerization - Aluminum chloride process and isomerization with platinum catalyst. Polymeriztion - Types of polymerizations, mechanism of polymerization, polymerization in presence of sulphuric acid, polymerizations in presence of phosphoric acid.

UNIT-III

Ethylene Derivatives: various products with ethylene as the starting materials. Manufacturing of the following - Vinyl Chloride Monomer, Perchloroethylene " pyrolysis of carbon tetra chloride, chlorination and pyrolysis method, Ethyl alcohol by direct hydration and liquid phase hydration methods, Vinyl acetate monomer, Ethylene oxide and its applications , Polyethylene, Styrene.

Unit-IV

Propylene derivatives: list of propylene derivatives. Manufacturing of the following - Isopropyl alcohol, Acetone by catalytic dehydrogenation, Propylene oxide, Glycerine by Acrolein, allyl chloride and by isomerization of propylene oxide methods. Derivatives of C_4 Hydrocarbons: List of butadiene derivatives, Manufacturing of butadiene from n-butylene and by oxidative dehydrogenation., Purification of butadiene

UNIT-V

Derivative of Higher Paraffins:-Manufacturing of Isoprene, olefins of C_5 , C_6, long chain and straight chain Olefins.

Derivatives of Aromatics: Sources of aromatic compounds, production of aromatics. Effect of temperature, pressure and catalyst on dehydrogenation process. Separation of aromatics from Non-aromatics and separation of aromatics into individual streams

Text Books:

1. W.L.Nelson, "Petroleum refinery engineering" 4th ed., McGraw Hill company, 2013.
2. B.K.Bhasker Rao, "Modern petroleum refining process", 5th ed., Oxford and IBH, 2008.

Suggested Readings:

1. N.K.Sinha, "Petroleum Refining and Petro Chemicals", 1st edition, Umesh publications, 2003.
2. Kirk-Othmer, "Encyclopedia of Chemical Technology", 3rd Ed..John Wiley and sons.Inc, 2004.

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16CH C 26

PROCESS EQUIPMENT DESIGN

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives: This course helps the students to understand the

1. Classification of unfired pressure vessels observed in process industries.
2. Mechanical design of process vessels for shells, domes and other significant component parts.
3. Process design of reactors based on their operation.
4. Sieve-tray hydraulics and downcomer design of distillation columns.
5. Shell and tube heat exchanger design and applications

Course outcomes: At the end of the course, the students will be able to

1. Identify the design needs for process equipment based on operating conditions of chemical plant operation.
2. Design flanges and nozzles and to select the right component parts for any process vessel
3. Design process equipments like storage vessels, reactors.
4. Design continuous distillation for multi component system
5. Design shell and tube heat exchanger (1-2)

UNIT – I: Design of Pressure Vessels

Classification of equipment, types of pressure vessels, General design considerations for process equipment like pressure, temperature, codes and standards, stresses, welding categories, material of construction, corrosion allowance, major and minor constraints.

Design and calculations for thin-walled vessels under internal pressure: cylindrical and spherical shells, domes – flat plates, torispherical, elliptical, hemispherical, conical heads.

Design of thin-walled vessels under external pressure: cylindrical shells, vessel heads, need and types of stiffeners.

UNIT – II: Design of Vessel Components

Significant component parts of process vessels. Flanges and gasket – classification, types, design calculations for loose type non-standard flanges. Equipment supports – types, selection criteria. Nozzles – design calculations for deciding the compensation requirements for openings and branches. Jackets for process vessels – Types, selection criteria, comparison with immersion coils.

UNIT – III: Design of Reactors

Reactors – classification basis, types, selection criteria, application, comparison. Process design – significance of mass and energy balances, reaction rates. Calculations to estimate volume of reactor.

UNIT – IV: Design of Continuous stage-wise Distillation Column

Design of tall columns under combined loading – source of loads, stress balance – pressure, wind and weight loads.

Prediction of plate efficiency of distillation columns – types and design methodology.

Underwood-Fenskee method for design of continuous distillation with multiple feeds and side streams for multi component system (three component).

UNIT – V: Design of Shell and Tube Heat Exchanger (1-2)

Introduction to Heat Exchangers, Temperature difference, Pressure drop in shell and tube side, overall heat transfer coefficient, LMTD calculation, Flow arrangement for increased heat recovery (1-2 shell tube heat exchanger)

Design of Shell and Tube Heat exchanger, shell side film coefficients, shell side pressure drop.

Text Books:

1. Dr. Shrikanth D. Dawande, “Process Design of Equipments” Vol. 1 & 2, Central Techno Publications, Nagpur, 2000.
2. D Q Kern, “Process Heat Transfer” International Edition 1965, McGraw-Hill Book.

Suggested Readings:

1. M.V. Joshi, “Process Equipment Design”, 2nd Ed., McMillan Co. of India Limited, Madras, 1976.
2. J.M.Coulson, J.F.Richardson, R.K. Sinnott, “Chemical Engineering Design”, Vo1. 6, Ed 3, Butterworth – Heinemann publishers, New York, 2000.
3. Ernest E. Ludwig, “Applied process design for chemical and petrochemical plants”, Vol 3, Elsevier Inc., 2001.
4. Bachurst, J.R. and Harker, J.H, “Process Plant Design”, American Elsevier Pub. Co., London, 1973.

16CH C 27

TRANSPORT PHENOMENA

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives: This course helps the students to understand the

1. Fundamentals to solve flow problems involving transport of momentum, energy and mass using a unified approach.
2. Analogy between momentum, mass and energy transport.
3. Turbulent phenomena and the methods of characterizing the turbulent fluxes
4. Equations of change for isothermal and non-isothermal systems and multi-component mixtures.
5. Development of governing equations

Course Outcomes: At the end of the course, student will be able to

1. Apply the first principles to solve various chemical engineering problems.
2. Compare various flow phenomena
3. Develop expressions for steady state velocity, temperature and concentration profiles using shell balance method
4. Apply equations of change to solve flow problems.
5. Develop expressions for unsteady state isothermal and non-isothermal flows

UNIT – I

Introduction – Mechanism of molecular transport of momentum, heat and Mass Transfer. Flux equations – Newton's, Fourier's and Fick's laws - Similarities and differences

Non-Newtonian fluids, transport properties – estimation, temperature and pressure dependence, estimation of transport properties of binary gaseous mixtures

Velocity distributions in laminar flow – shell momentum balances – Flow of falling film – flow of fluids through circular tubes, annulus and Immiscible fluids between parallel plates.

UNIT – II

Temperature distributions in solids and in laminar flow – shell balances - Heat conduction with electrical, Nuclear, viscous and chemical heat source Heat conduction through composite walls, and cooling fin; Forced convection and free convection

UNIT – III

Concentration distributions in solids and in laminar flow - shell mass balances, diffusion through a stagnant gas film, Diffusion with homogenous chemical reaction and heterogeneous chemical reaction. Diffusion into a falling liquid film-chemical reaction inside a porous catalyst

UNIT – IV

Equations of change for isothermal systems – Equation of continuity, Equation of Motion, Equations of change, use of equations of change to set up steady flow problems. Equations of change for non-isothermal systems – Equation of energy – use of equations of change to set up steady state flow problems. Equation of change for a binary mixture – Equation of continuity of a component in curvilinear coordinates

UNIT – V

Unsteady state problems in momentum, energy and mass transfer operations; Turbulence - Time smoothing of equations of change of momentum, energy and Mass Transfer; Eddy properties - Intensity of turbulence Reynolds stresses; Semi empirical expressions for turbulent –Momentum – energy and mass fluxes

Text Books:

1. R.B.Bird, W.E.Stewart, and E.N.Lightfoot , "Transport Phenomena", John Wiley & Sons. Inc. 2002

Suggested Readings:

1. R.S.Broadkay, "Introduction to Transport Phenomena", McGraw Hill Publications, 1980.
2. J. R. Welty, C. E Wicks and R. E. Wilson, Fundamentals of Momentum, Heat and Mass Transfer, 3rd Ed., 1984
3. Geankoplis, "Transport Processes and Separation Processes Principles". 4th Edition, Prentice Hall, 2003

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16CH E 11

POLYMER TECHNOLOGY

(CORE ELECTIVE V)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives: This course helps the students to understand the

1. To provide a fundamental knowledge on polymers and their chemical, physical and mechanical behavior.
2. Understand the structure-processing-property relationship of polymers.
3. Emphasis is on the processing techniques, along with the production of polymers.
4. To understand the synthesis, manufacture, processing and characterization of different polymers
5. To understand the basic issues involved in polymer blends, composites and nanocomposites.

Course Outcomes: At the end of the course, student will be able to

1. Familiarize the polymers, polymerization techniques and behavior in polymers
2. Understand the different types of polymerization.
3. Illustrate the different techniques used to determine the molecular weight of polymers
4. Impart knowledge on various testing methods and characterization of polymers
5. Familiarize the various polymer processing techniques for polymers, rubbers and fibers

UNIT-I

Definitions and concepts of terms used in polymer engineering, Classification of polymers; Polymer structures, functionality; polymerization reactions – mechanism of polymerization; stereospecific polymerization, copolymerization. Polymer material structure and Properties: Deformation, flow and melt characteristics. Morphology and order in crystalline polymers. Rheology and the mechanical properties of polymers. Polymer structure and physical properties.

UNIT-II

Polymerization reactors, polymerization processes, characterization of polymers, analysis of polymerization reactions, polymer degradation, Condensation polymerization, Addition polymerization, Ionic and coordination polymerization.

UNIT-III

Molecular weight and molecular weight distribution in polymers, properties of polymers – physical, chemical, mechanical and electrical properties of polymers, elementary idea on polymer rheology, polymer blends. Experimental methods for molecular weight determination: cryoscopy, ebulliometry, membrane osmometry, light scattering method, viscometry, intrinsic viscosity measurement, gel permeation chromatography. Structure and Properties: Thermal transitions, Crystallinity, Molecular weight characterization, Nuclear Magnetic Resonance (NMR) and Fourier Transform Infrared (FTIR) techniques.

UNIT–IV

Polymer processing: modeling – compression & transfer, injection & jet; casting; extrusion, calendaring, lamination, spinning & finishing. Processing methods , effect of additives used, plasticizers, colourants, heat stabilizers, antioxidants, ultraviolet absorbers, antistatic agents, flame retardants, blowing agents, fillers etc. Molding techniques for plastics, injection molding, compression molding, calendaring, blow moulding, extrusion, thermoforming, spinning methods for fibres, compounding methods for elastomers, general study of elastomer processing methods.

UNIT-V

Industrial polymers: Manufacturing processes, properties and uses of Polyethylene, Polypropylene, Polyvinylchloride, Polystyrene, Nylon, Polyethylene terephthalate. Hydrocarbon plastics and elastomers. Other carbon chain polymers. Heterochain thermoplastics. Thermosetting resins. Polymer Blends: Types, Compatibility, Thermal and Mechanical Properties. Polymer Composites: Types, Properties, Preparation, Fibre-reinforced composites, In-situ composites. Polymer Nanocomposites: Basic concepts, Processing, Characterization.

Text Books:

1. Text Book of Polymer Science, F. W. Billmeyer, John Wiley, New York
2. Polymer Science & Technology, P.Ghosh, TMC

Suggested Readings:

1. The elements of Polymer Science & Engineering, Alfred Rudin, Academic Press, 2nd Edition.
2. Introduction to Polymers, R. J. Young, Chapman & Hall, London

16CH E 12

PULPAND PAPER TECHNOLOGY
(COREELECTIVE V)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Basic concepts of Pulp and Paper making processes
2. Details of physical and chemical characteristics of fibrous raw materials and black liquor
3. Various types of cooking and bleaching methodologies
4. Recovery of energy and chemicals used in pulping processes with due techno-economic and environmental considerations
5. Different paper testing methods

Course outcomes: At the completion of this course, students will be able to

1. Design the operation, maintenance and safety aspects for paper making.
2. Identify the factors that drive industry trends.
3. Grade paper and boards based on different testing methods.
4. Select appropriate bleaching technique for required paper quality.
5. Differentiate the important wood and fiber properties that affect paper quality.

UNIT – I: Introduction

Importance of Paper: Definitions of Pulps

Wood Parts & Types: Ultra structure of Cell Wall, Wood cell types, Early & Latewood, Softwoods, Hardwoods & Non-woods. Comparison of different raw materials. Distribution of Wood Constituents – Cellulose, Hemi-cellulose, Lignin, Extractives and Inorganic components.

UNIT – II: Overview of pulping process

Mechanical Pulping: Pressurized ground pulping, Refiner Pulping, Chemo (thermo) mechanical pulping processes.

Kraft Pulping: Description of Kraft Cooking Process, Kraft recovery, Composition & Analysis of white liquor, Chemical reactions & process variables. Pulp yield, End uses of kraft pulps.

UNIT – III: Pulp and black liquor characterization

Pulp testing methods - Kappa number, water retension value, CED viscosity, drainability, beater evaluation, zero span tensile strength.

Black liquor characterization - Chemical properties, viscosity and rheological behavior at different concentrations, thermal properties, calorific value, thermal conductivity, specific heat, black liquor oxidation, desilication and concentration of black liquor.

UNIT-IV: Bleaching operations

Objectives of bleaching – Elemental chlorine free and total chlorine free bleaching; Bleachability and its measurement, bleaching reactions, reaction kinetics and operating variables for different bleaching agents like ClO_2, O_2, O_3, hypochlorite, H_2O_2.

Stages of bleaching – Oxygen delignification, Chlorination, Extraction, Hypochlorite bleaching, Ozone bleaching, Peroxide bleaching, Operating variables for different bleaching stages; ECF and TCF bleaching systems for chemical pulps; bleaching systems for mechanical and high yield pulps.

UNIT – V: Paper Making and its Properties

Paper Testing Methods – Flowsheet of complete pulp and paper making process, Strength properties, Surface properties, Optical properties & Absorption properties. Different grades of paper, boards & newsprint specifications; BIS and ISO standards of paper. Paper properties dependence on paper making processes, Calibration of instruments. Paper recycling process, Effluent treatment processes with environmental considerations.

Text Books:

1. Kenneth W. Britt , “ Handbook of Pulp & Paper Technology”, 2nd Edition, Reinhold Publishing Corporation, 2004.
2. G.A Smook ., “Handbook for Pulp & Paper Technologists” , 3rd Edition, Angus Wilde Publications, 2003.

Suggested Readings:

1. Hakan Karlsson, “Fiber Guide-Fiber analysis and process applications in the pulp & paper industry”, Ab Lorentzen and Wetre, 1st Ed., 2006.
2. EIRI Board ., “Handbook of Pulp & Paper, Paper board and Paper based Technology”, Engineers India Research Institute, 2nd Ed., 2015.

16CH E 13

POLLUTION CONTROL IN PROCESS INDUSTRIES
(CORE ELECTIVE V)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Effects of pollution on environment and ecosystems
2. Types and sources of pollution from process industries,
3. Measurement of air and water pollution in process industries
4. Different methods and equipment used in industrial pollution abatement
5. Pollution control practices in process industries

Course outcomes: At the completion of this course, students will be able to

1. Differentiate the types of wastes generated in an industry, their effects on living and non-living things
2. Understand the effect of climate changes, atmospheric dispersion of air pollutants, and operating principles.
3. Working principles of particulate control devices.
4. Quantify industrial wastewater and its treatment.
5. Analyze the hazardous and nonhazardous solid wastes and select the treatment and disposal methods.

UNIT - I Introduction

Definition and types of pollution from chemical industries. Effects of pollution on environment and ecosystems - global warning - greenhouse effect. Laws and standards for pollution. Sources, types, characteristics and effects of air pollutants, liquid effluents, solid wastes in process industries.

UNIT – II Air Pollution

Meteorological aspects of pollution dispersion, adiabatic and environmental lapse rate, Turbulence and stability of atmosphere. Indoor air pollution - smoke and hydrocarbons. Richardson Number, Plume raise, plume behavior and characteristics, effective stack height.

General Control Methods and Equipment: removal of sulphur dioxide, oxides of nitrogen and carbon, organic vapors from gaseous effluents. Removal of particulate matter - principle and working of settling chambers cyclone separators solid traps, fabric and fiber filters, electro-static precipitators.

UNIT – III: Water pollution

Concepts and estimation of oxygen demands - DO, BOD, COD, TOD. Oxygen sag curve, BOD curves and modeling. Wastewater Treatment – Concept, significance and classification as Primary, Secondary, Tertiary methods. Principle, working mechanism and applications of biological treatment techniques like stabilization ponds, Aerated lagoons, conventional activated sludge process, aerobic and anaerobic methods, suspended and attached growth processes, fluidized bed contractors. Trickling filters.

UNIT - IV Introduction to industrial Solid waste management

Industrial solid wastes " Types, classification, properties, management and general disposal methods. industrial solid wastes – environmental effects and disposal methods commonly practiced. Methods practiced in paper and textile industries.

UNIT - V Pollution control practices in Process Industries

Principle, working mechanism and application of tertiary treatment methods like carbon adsorption, Ion-exchange, Reverse Osmosis, Ultra Filtration in process industries.

Sludge treatment and disposal methods like Incineration and land filling. Pollution control in petroleum and fertilizer industries

Text Books

1. C.S.Rao, " Environmental Pollution Control Engineering ", 2nd Ed, New Age International, 2007.
2. S.P.Mahajan, " Pollution control in process industries", 27th Ed, McGraw Hill Pub., 2002.

Suggested Readings:

1. Metcalf and Eddy, " Wastewater Engineering: Treatment and Reuse", 4th Edition , MGH publishing, 2004.
2. M.N Rao and H.V.N Rao, "Air Pollution", Tata McGraw- Hill Publishing Company Limited, New Delhi, 2000.
3. Peavy, H.S., Rowe, D.R. and Technobanolous, G., "Environmental Engineering", McGraw Hill, 1985.

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16CE O 02

DISASTER MITIGATION AND MANAGEMENT

(OPEN ELECTIVE I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. Nature, causes, consequences and mitigation measures of the various natural disasters
3. Risks, vulnerabilities and human errors associated with human induced disasters
4. Impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. Chronological phases in a disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course outcomes: At the completion of this course, students will be able to

1. Ability to analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. To understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

UNIT-I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II:

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III:

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT-IV:

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

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Text Books:

1. Pradeep Sahni, *Disaster Risk Reduction in South Asia*, Prentice Hall, 2003.
2. B. K. Singh, *Handbook of Disaster Management: techniques & Guideline* , Rajat Publication, 2008.

Suggested Readings:

1. Ministry of Home Affairs". *Government of India, "National disaster management plan, Part I and II",*
2. K. K. Ghosh," *Disaster Management",* APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

16ME O 01

ENTREPRENEURSHIP (OPENELECTIVEI)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Course outcomes: At the completion of this course, students will be able to

1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

UNIT-I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT-II

Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT-III

Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

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UNIT-IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V

Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Readings:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.
3. Sudha G.S., "Organizational Behavior", National Publishing House, 1996.

16ME O 04

INTELLECTUALPROPERTYRIGHTS
(OPENELECTIVEI)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

Course outcomes: At the completion of this course, students will be able to

1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT

Patents: Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

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UNIT-III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.

Unfair Competition: What is unfair competition. Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications", Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications", Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan, "Law of Copyright and Industrial Designs", Eastern law House, Delhi 2010

Suggested Readings:

1. W.R1 Cronish, "Intellectual Property; Patents, copyright, Trad and Allied rights", Sweet & Maxwell, 1993.
2. P. Narayanan, "Intellectual Property Law", Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs", 4/e, Sweet, Maxwell,.

16EG O 01

TECHNICAL WRITING SKILLS
(OPEN ELECTIVE I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. Process of communication and channels of communication in general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

Course outcomes: At the completion of this course, students will be able to

1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

Unit I

Communication – Nature and process.

Channels of Communication – Downward, upward and horizontal communication. Barriers to communication.

Technical Communication – Definition, oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

Unit II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing.

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Abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

Unit III

Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters.

Technical Articles: Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

Unit IV

Technical Reports: Types, significance, structure, style and writing of reports. Routine reports, Project reports.

Technical Proposals : Definition, types, characteristics, structure and significance.

Unit V

Mechanics of Meetings: Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.

Technical Presentations : Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Text Book

1. Meenakshi Raman & Sangeeta Sharma, **"Technical Communications-Principles and Practice",** Oxford University Press, Second Edition, 2012.
2. 1.MAshraf Rizvi, **"Effective Technical Communication",** Tata McGraw Hill Education Pvt Ltd, 2012.

Suggested Readings:

1. Kavita Tyagi & Padma Misra, **"Basic Technical Communication",** PHI Learning Pvt Ltd, 2012.
2. R.C Sharma & Krishna Mohan, **"Business Correspondence and Report Writing",** Tata McGraw Hill, 2003

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. https://www.technical-writing-training-and-certification.com/
3. https://academy.whatfix.com/technical-writing-skills

16CH C 28

EQUIPMENT DESIGN AND DRAWING LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

LIST OF EXERCISES

1. Symbols for Piping and Instrumentation.
2. Flow sheet symbols for unit operations.
3. Types of Heat transfer equipment and their representation symbols.
4. Process fluid transport equipment symbols.
5. Development and drawing of few flow sheets.
6. Typical layout, mechanical design and elevation drawings of storage vessels.
7. Design and elevation drawings of Reactor kettles.
8. Layout, design and elevation drawings of heat exchangers.
9. Elevation drawings and design of plate distillation column.

Text Books

1. Vilbrandt, C.T. and Dryden, C.E., "Chemical Engineering plant design", 4th Ed., Kogakusha, 1979.
2. Joshi, M.V. "Process Equipment Design", 2nd Ed., McMillan Co. of India Limited, Madras, 1976.
3. Bachurst, J.R. and Harker, J.A. "Process Plant Design", Heiman Education Books, London, 1973.
4. Evans, F.L., "Equipment Design Hand Book for refineries and Chemical Plants", Vol .I, 1979, Vol. II, 1980, Gulf Publishing Co., Houston, Texas.

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16CH C 29

MASS TRASNFER OPERATION LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

LIST OF EXERCISES

1. Determination of concentration profile for the given system
2. Estimation of diffusivity coefficient for the gaseous system (CCl_4 - Air)
3. Estimation of diffusivity coefficient for the liquid system (H_2SO_4 - water)
4. Determination of vapor - liquid equilibrium data for the given system.
5. Estimation of vaporization efficiency and prediction of steam distillation temperature.
6. Verification of the Rayleigh's equation for the system of methanol and water.
7. Determination of the capacity coefficient of the packed column under total reflux conditions and calculation of height equivalent to theoretical plate.
8. Development of the solubility curve for the given system
9. Prediction of Liquid - Liquid equilibrium data for the given system and determination of the plait point.
10. Calculation for percentage of extraction of solute from solid mixture using a solvent (Solid-Liquid extraction).
11. Estimation of the mass - transfer coefficient k_G for Air- Water system and plotting the variation of k_G with Reynold's number.
12. Developing the drying curve by using tray drier and estimation and composition of time required for drying the given solid.

Text Books

1) Christie John Geankoplis, " Transport Processes and Separation Process Principles" , 4th Ed., Prentice Hall India, 2003.
2) McCabe and Julian Smith and Peter Harriott, " Unit Operations of Chemical Engineering", 7 th Ed., McGraw Hill Book Company, 2005.
3) R.E.Treybal, "Mass Transfer Operations", 3rd Edition, McGraw Hill Book Company 1981.

16CH C 30

SEMINAR

Instruction	3 Hours per week
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
Choice Based Credit System (with effect from 2019-20)
B.TECH (Chemical Engineering)

SEMESTER – VIII

S. No.	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1.	16CH C 31	Plant Design Economics	3	-	3	30	70	3
2.	-	Core Elective-VI	3	-	3	30	70	3
3.	-	Open Elective-II	3	-	3	30	70	3
4.	16CH C 32	Project Seminar	-	3	-	50	-	2
5.	16CH C 33	Project	-	6	viva	50	100	6
Total			**9**	**9**	**--**	**190**	**310**	**17**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE – Continuous Internal Evaluation SEE - Semester End Examination

Core Elective-VI	
16CH E 14	Membrane Separation Technology
16CH E 15	Sugar Technology
16CH E 16	Food Technology

Open Elective-II	
16ME O 05	Nano Materials and Technology
16CS O 03	iOT and application
16PY O 01	History of Science and Technology
16EG O 02	Gender Sensitization

16CH C 31

PLANT DESIGN AND ECONOMICS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the
1. Fundamentals of investments and engineering economics.
2. Flow sheet synthesis and integrate with process equipment design.
3. Design concepts with principles of process economics.
4. Methods to quantify concepts such as fixed capital investment, cash-flow analysis, profitability analysis and decision making.
5. Piping and tubing specifications, P and ID diagrams

Course outcomes: At the completion of this course, students will be able to
1. Calculate the time value of money and depreciation.
2. Estimate fixed and working capitals and operating costs for process plants.
3. Evaluate the profitability of process industry projects using measures such as ROI, NPV and DCF
4. Identity and apply the selection criteria for design of flow sheets, equipment and material.
5. Design the piping specifications as per standards.

UNIT – I

Economic equations. Present and future worth. Equivalence and value for money. Nominal and effective interest rates.

Capitalized cost, sinking fund, definition of bond and problems. Types of depreciation and problems.

UNIT - II

Capital requirements by Chilton and Lang, Schweyer, Cost indices methods. Total investment schedule. Sources of capital. Balance sheet and problems. Economic charts. Problems on break even, variable cost, fixed cost. Estimation of profit and capital ratios.

UNIT - III

Selection of alternative equipment or plants by annual cost. Present cost and Capitalized cost methods. Replacement of existing equipment. Rate of return and payout time methods and problems.

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UNIT – IV

Process evolution. Stages of process design. Types of flowsheets. Selection criteria of process equipment - material handling (solids, liquids & gases) - separation equipment (solid - solid sold - liquid, liquid - solid etc), Size reduction equipment, agitators, drying equipment filtration equipment, reactors. Procedure for material selection. Introduction to Design and Automation of process plants. Examples.

UNIT – V

Piping and tube specifications, pipe fabrication methods, piping material, principles of piping layout, piping stresses, stress design and supports. Pressure drop in pipe lines, piping friction factor, design of pipe lines for natural gas, selection of valves. Introduction to P & ID Diagrams.

Text Books

1. Max. Peters, K Timmerhaus and Ronal West, "Plant Design and Economics for Chemical Engineers", 5th Ed., McGraw Hill Publications, 2003.
2. C.Vilbrandt and Dryden C.E, "Chemical Engineering Plant Design", 4th Ed, MGH Book Co., Reprints 2015.

Suggested Readings:

1. Seider W.D., Seader J.D. & Lewin D.R., "Product and Process Design principles: Synthesis, Analysis and Evaluation", John Wiley & Sons, Inc., 2nd ed., 2010
2. J.M. Coulson and J.F Richardson, "Chemical Engineering", Vol.6, 5th ed. Pergamon and ELES, 2003.
3. H.E.Schweyer., "Process Engineering Economics", MGH Book Co, NewYork, 2001.

16CH E 14

MEMBRANE SEPARATION TECHNOLOGY
(COREELECTIVEVI)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will help the students to understand the

1. The fundamental principles and applications of different membrane processes
2. Types of membranes and preparation
3. Selection criteria for membrane processes
4. Various installations for Membrane Processes and simple design considerations
5. Design of membrane systems

Course outcomes: At the completion of this course, students will be able to

1. Understand different types of membrane processes
2. Identify a membrane process for a specific application
3. Understand the types and preparation of membranes
4. Calculate performance factors for various membrane processes
5. Write design equations for simple membrane modules

UNIT – I Introduction to Membrane Separation Processes: Classification of separation processes - Separating agents - principles of gas permeation, reverse osmosis, ultra-filtration, pervaporation, dialysis, Electro-dialysis.
Applications of membranes - for the separation of gases, waste water treatment, pulp and paper, electroplating and Electro-coating industries, food industry - denaturing of liquid foods, cheese making and whey processing

UNIT – II Preparation of Membranes: Basic introduction to different types of membrane materials. Basics of preparation of synthetic membranes - Sintering, Stretching, Track-Etching, Template Leaching, Phase-inversion, Coating, Sol-gel process

UNIT – III Ideal Separation on Capabilities of Membrane Processes: Separation factor, rejection factor, expressions for ideal separation factors in various membrane processes.

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Secondary Phenomena in Membrane processes: Secondary physical and transport phenomena in membrane processes, concentration polarization in membrane processes.

UNIT – IV Equipment for Membrane Processes: Flat sheet, tubular, spiral wound and hollow fiber membrane modular designs for various membrane processes, single entry and double entry separating elements, separation stage. Flow configuration in membrane systems.

UNIT – V Design of Membrane Systems: Design equations for perfect mixing and cross flow configuration, separation stages for gas permeation, reverse osmosis and ultra filtration. Design equations for perfect mixing and parallel flow dialyze. Simple design equations for Electro-dialytic stacks

Text Books

1. Kaushik Nath, "Membrane Separation Processes", PHI Learning, 2008
2. Marcel Mulder, "Basic Principles of Membrane Technology", Kluwer Academic Publishers, 2nd Ed., 1996.

Suggested Readings:

1. Membrane Technology Lecture series of Winter School conducted at College of Tech, O.U., December, 1987
2. W L McCabe, J C Smith and P Harriot, "Unit Operations of Chemical Engineering", 7th Ed., Mc-Graw Hill, 2005
3. Christie John Geonkoplis "Transport Processes and Separation Process Principals", Pearson New Intl. Ed., 2013

16CH E 15

SUGAR TECHNOLOGY
(COREELECTIVEVI)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the

1. Performance measures of different types of unit operations in sugar processing
2. Applications, advantages and limitations of the processing procedure
3. Competence and optimization of advanced technology in sugar processing.
4. Crystallization methodology and their applications
5. Possible byproducts of any sugar industry and production of salable derivatives.

Course outcomes: At the completion of this course, students will be able to

1. Principles and skills of work in sugar cane milling, processing and refining in practical settings.
2. Analyze the composition of different types of sugars by volumetric and gravimetric determination.
3. Different unit operations for effective processing of cane juice.
4. Batch and continuous methods for an efficient operation of sugar industry.
5. Concepts of quality assurance and control in industry as per Indian regulations and practices.

UNIT-I

Importance of sugar industry. Different raw materials for sugar manufacturing, composition of raw materials, history, origin and distribution of sugarcane, production and productivity of sugarcane in India. Indian sugar industry on global screen. Manufacturing processes of raw sugar and crystalline white sugar. Reducing sugars - composition, volumetric and gravimetric determination methods.

UNIT-II

Conveying of raw materials - cane carrier and feeding table working principles. Cane preparation – objective, sieving, preparation index, cane knives, crushing

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and shredding applications. Extraction of cane juice by milling operation - basic concept of roller mills, working principles, conditions for good milling operation, milling efficiency, maceration and imbibitions – importance, effect, method, objective and efficiency. Cane juice clarification – simple, compound and neutral defaction procedures. Sulphitation and carbonation - batch and continuous methods. Single and double carbonation process, De-Hans process, comparison of different clarification modern techniques.

UNIT-III

Juice heaters - construction and working principles. Juice filtration - plate and frame filter presses, RVDF, types of filter cake washing. Evaporation- multiple effect evaporators - construction and operation. Steam economy and capacity. Vacuum pan boiling - construction, types of pans, speed of circulation, heating surface to volume ratio, pan boiling techniques, different boiling schemes.

UNIT-IV

Crystallization – nucleation, graining methods, advantages and disadvantages of graining. Theory of crystallization, crystallization zone, crystal growth. centrifuge –construction & working, factors influences on time of curing. Advantages and disadvantages of batch / continuous centrifugal machine. Separation of molasses-different molasses conditioning methods, precautions during molasses conditioning.

Sugar drying -various aspects regarding drying and cooling, rotary dryer. Packing of sugar -types of sugar grader, dilution indicator, quality and safety factors, location and stalking of sugar bags.

UNIT-V

Sugar byproducts: bagasse, pressmud and molasses- their composition and applications. Production of bio-gas, fibre board, furfurol filter mud, extraction of cane wax, manure, industrial alcohol and rectified spirit. Sugar scales and normal weight.

Text Books

1. Meade and Chen, " Hand of book of cane sugar", 11th Ed , Wiley Interscience, New York, 2001.
2. James C.P Chen, "Cane Sugar Hand book", 12th Ed, Elsevier Pub. Co., New York, 1993.

Suggested Readings:

1. R B L Mathur, Hand Book of Cane Sugar Technology", 2nd Ed, Oxford & IBH, 1978.
2. John H. Payne, "Unit operation in cane sugar production", Sugar series book 4, Elsevier Pub. Co., New York, 1982.

16CH E 16

FOOD TECHNOLOGY
(COREELECTIVEVI)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives: This course helps the students to understand the

1. Basic food preparation techniques. Food quality.
2. Physical, chemical, and/or microbiological changes in food and mechanical manipulation.
3. Learn fundamentals of modifying food to meet current nutrition recommendations
4. Learn to find credible sources of information re. food science and nutrition.
5. Food processing Applications and Packaging

Course Outcomes: At the end of the course, student will be able to

1. Explain techniques in food processing
2. Design process equipment to achieve the desired quality of food.
3. Develop novel food processes that have a minimal effect on food quality
4. Select control strategies to maintain food quality
5. Apply the scientific method to food science problems

UNIT–I

Introduction: General aspects of food industry, World food demand and Indian scenario, Constituents of food, Quality and nutritive aspects, Product and Process development, engineering challenges in the Food Processing Industry.

UNIT–II

Basic principles: Properties of foods and processing theory, Heat transfer, Effect of heat on micro-organisms, Basic Food Biochemistry and Microbiology: Food Constituents; Food fortification, Water activity, Effects of processing on sensory characteristics of foods, Effects of processing on nutritional properties, Food safety, good manufacturing practice and quality Process Control in Food Processing.

UNIT–III

Ambient Temperature Processing: Raw material preparation, Size reduction, Mixing and forming, Separation and concentration of food components, Centrifugation, Membrane concentration, Fermentation and enzyme technology, Irradiation, Effect on micro-organisms, Processing using electric fields, high hydrostatic pressure, light or ultrasound.

UNIT–IV

Heat processing using steam, water and air: Blanching, Pasteurization, Heat sterilization, Evaporation and distillation, Extrusion, Dehydration, Baking and roasting, Heat processing by direct and radiated energy: Dielectric heating, Ohmic heating, Infrared heating, Gamma irradiation.

UNIT–V

Post Processing Applications Packaging: Coating or enrobing, Theory and Types of packaging materials, Printing, Interactions between packaging and foods, Environmental considerations.

Text Books:

1. Fellows P., Food Processing Technology: Principles and Practice, Wood head Publishing, 4th Edition, 2016.
2. Toledo R, Fundamentals of Food Process Engineering, Springer, 3rd Edition, 2010.

Suggested Reading:

1. Singh R.P. & Heldman D.R., Introduction to Food Engineering, Academic Press, 3rd Edition, 2001.

16ME O 05

NANO MATERIALS AND TECHNOLOGY
(OPEN ELECTIVE II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the

1. Nanotechnology approach and challenges
2. Materials and characterization procedures
3. Zero and One dimensional Nano structures
4. Various Fabrication Techniques
5. Special nano materials and Nano biomaterials

Course outcomes: At the completion of this course, students will be able to

1. Understand the developments and challenges in nano technology
2. Understand magnetic and electronic properties and its microstructure
3. Learn synthesis and characterization techniques of Zero and One dimensional Nano structures and their applications
4. Study various Nano Material Fabrication Techniques
5. Understand the applications of special nano materials and nano bio materials

UNIT-I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance of Nanotechnology, Bottom-up and Top-down approaches, challenges in nanotechnology

UNIT-II

Materials of Nanotechnology: Introduction, Si-based materials, Ge-based materials, Ferroelectric materials, Polymer materials, GaAs& InP (HI-V) group materials, Nanotribology and materials, characterization using Scanning Probe Microscope, AFM

UNIT-III

Nano Structures: Zero dimensional Nanostructure, synthesis procedure by heterogeneous method, characterization techniques, properties and applications of Nano particles

One dimensional Nanostructures: Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires

UNIT-IV

Nano Fabrication: Introduction, Basic fabrication techniques by Lithography and doping, MEMS fabrication techniques, Nano fabrication techniques by E-beam, Nano-imprint fabrication, Epitaxy and strain engineering

UNIT-V

Special Nano Materials: Introduction, Synthesis procedure by metal-polymer, Characterization procedures, applications

Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, applications

Text Books:

1. Dieter Vollath, "Nanomaterials: An introduction to Synthesis, properties and applications", Wiley, 2013
2. Guozhong Cao, "Nanostructures and Nano Materials, Synthesis properties and applications", Imperial College Press
3. Carl C Koch, "Nano materials Synthesis , Properties and applications", Jaico Publishing House

Suggested Reading:

1. Willia Tllsey Atkinson, "Nano Technology", Jaico Publishing House
2. George W. Hanson, "Fundamentals of Nanoelectronics", Pearson Education, 2009
3. T. Pradeep, "Nano: Essentials-understanding Nano Science and Technology", TMH, 2007

16CS O 03

Iot AND APPLICATIONS
(OPEN ELECTIVE II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Impart necessary and practical knowledge of components in Internet of Things.
2. Understand working of IOT Systems.
3. Develop skills required to build IOT based systems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand Internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Remotely monitor data and control devices.
4. Develop real time IOT based projects.
5. Advance towards research based IOT.

UNIT – I

Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators and Types of Actuators.

UNIT – II

Basics of Networking: Functional Components of IoT, IoT interdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

UNIT – III

IoT Hardware Components: Computing (Arduino/Raspberry Pi), Communication, Sensors, Actuators, I/0 interfaces, Programming API's (for Arduino/ Raspberry Pi).

UNIT – IV

IoT Application Development: Solution framework for IoT applications-Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, Authorization of devices

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UNIT – V

IoT Systems and Applications: Smart Lighting, Weather Monitoring System, Weather Reporting Bot, Forest Fire Detection, Alcohol Detection System, Smart Parking Environment., Drip-irrigation, Biological water treatment system, Work flow Automation in Industries, Smart Intrusion Detection System, monitoring space risks and hazardous conditions in industrial regions like underground tanks , trap door margins.

Text Books:

1. Raj and Anupama C. Raman,"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.

Online Resources:

1. Li Da Xu, Wu He, and Shancang Li, "Internet of Things in Industries: A Survey ", IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. Gotovtsev, Pavel M., and Andrey V. Dyakov. "Biotechnology and Internet of Things for green smart city application." 2016 IEEE 3rd World Forum on Internet of Things (WF-IoT). IEEE, 2016.
3. Yanjing, Sun, et al. "Research and design of agriculture informatization system based on IOT." Journal of Computer Research and Development 48 (2011): 316-331.
4. Somov, Andrey, et al. "Bacteria to power the smart sensor applications: Biofuel cell for low-power IoT devices." 2018 IEEE 4th World Forum on Internet of Things (WF-IoT). IEEE, 2018.
5. Han, Shuqing, et al. "Analysis of the frontier technology of agricultural IoT and its predication research." IOP Conference Series: Materials Science and Engineering. Vol. 231. No. 1. IOP Publishing, 2017.

16PY O 01

HISTORY OF SCIENCE AND TECHNOLOGY
(OPEN ELECTIVE II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the

1. To enablestudents to understand science as a socio-cultural product in specific socio-historical contexts.
2. To expose students to philosophical, historical and sociological perspectives to look atscience as a practice deeply embedded in culture and society.
3. To inculcate the scientific culture and ethics in the development of technologies.

Course outcomes: At the completion of this course, students will be able to

1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rigor and sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

Unit-I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers,Agricultural Revolution and other revolutions,Civilization,Major advances.

Science in Antiquity (600 BC - 529 AD): Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

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Unit-II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances.

The Renaissance and the Scientific Revolution (1453 AD – 1659 AD): Renaissance, Scientific Revolution, Technology, Major advances.

Unit-III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances.

The Industrial Revolution (1735 AD – 1819 AD): Industrial Revolution, Rise of the engineer, Major Advances.

Unit-IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science,Science and the public, Science and technology, Major advances.

Rise of Modern Science and Technology (1895 AD – 1945 AD): The growth of 20th century science, Newphilosophies, Quantum reality, Energy sources, Electricity: a revolution intechnology, Majoradvances.

Unit-V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances.

The Information Age (1973 AD – 2015 AD): Information and society, Globalization, The post-industrial society,Problems of the Information age, Major Advances

Text Books:

1. Bryan Bunch and Alexander Hellemans, "The History of Science and Technology", Houghton Mifflin Company (New York), 2004
2. JD Bernal, "Science in History", 4 Volumes, Eklavya Publishers, 2012

Suggested Readings:

1. "The 100 Most Influential Scientists of All Time", Edited by Kara Rogers, Britannica Educational Publishing, 2010
2. Alberto Hernandez, "A Visual History of Science and Technology", The Rosen Publishing Group, 2016

16EG O 02

GENDER SENSITIZATION
(OPEN ELECTIVE II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course helps the students to understand the

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course outcomes: At the completion of this course, students will be able to

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

UNIT – I

Understanding Gender:

Gender: Why Should We Study It? (Towards a World of Equals: Unit -1)

Socialization: Making Women, Making Men (Towards a World of Equals: Unit -2) Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II

Gender And Biology:

Missing Women: Sex Selection and Its Consequences (Towards a World of Equals: Unit -4)

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Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary (Towards a World of Equals: Unit -10)
Two or Many? Struggles with Discrimination.

UNIT–III

Gender and Labour:

Housework: the Invisible Labour (Towards a World of Equals: Unit -3)
“My Mother doesn’t Work.” “Share the Load.”
Women’s Work: Its Politics and Economics (Towards a World of Equals: Unit -7)
Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV

Issues Of Violence

Sexual Harassment: Say No! (Towards a World of Equals: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading:
“Chupulu”.
Domestic Violence: Speaking Out (Towards a World of Equals: Unit -8)
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading:
New Forums for Justice.
Thinking about Sexual Violence (Towards a World of Equals: Unit -11)
Blaming the Victim-”I Fought for my Life….” - Additional Reading: The Caste Face of
Violence.

UNIT – V

Gender: Co - Existence

Just Relationships: Being Together as Equals (Towards a World of Equals: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.
Additional Reading: Rosa Parks-The Brave Heart.

Text Books:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu “Towards a World of Equals: A Bilingual Textbook on Gender” published by Telugu Akademi, Hyderabad, Telangana State, 2015.

Suggested Readings:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. “I Fought For My Life…and Won.”Available online at:
3. http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

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Gandipet, Hyderabad-75.

16CH C 32

PROJECT SEMINAR

Instruction	3 Hours per week
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/ Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks:Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

16CH C 33

PROJECT

Instruction	6 Hours per week
CIE	50 Marks
SEE	100 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/ Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 50)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

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Guidelines for awarding marks in SEE: (Max. Marks: 100)Max. Marks: 100

Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project ● Innovations ● Applications ● Live Research Projects ● Scope for future study ● Application to society
	20	Viva-Voce

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Gandipet, Hyderabad-75.

18CE C02

BUILDING CONSTRUCTION PRACTICE

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. To study about the basic building materials, properties and their applications.
2. To study about smart and Eco-friendly building materials.
3. To understand different types of masonries and their applications
4. To acquire concepts in building planning and to draw, plan, section, elevation of buildings with a flat /sloped roof.
5. To understand the concepts of framed RCC Structures, Roof trusses and formwork.

Course outcomes: At the end of the course the student is able

1. To identify various building materials and select suitable type for given situation.
2. To know different types of masonry, types of bonds used in construction of walls of buildings.
3. To know the different types of roofs, stair used in building works.
4. To plan suitable types of building and to prepare plan, section and elevation of building with flat / sloped roof.
5. To know the various components of RCC framed structure, RCC Structures, Roof trusses and formwork.

UNIT- I:

Traditional Building Materials: Properties, Types, Applications and testing of traditional building materials - Stone, Timber, Brick, Cement, Fly Ash, Sand, Coarse Aggregates, Mortar, Concrete and Steel.
Emerging Building Materials: Smart and Eco-Friendly materials - Sustainable materials - Recycled materials.

UNIT- II:

Concepts of Building Planning: Types of Buildings, Functional needs and differences in their planning requirements - Introduction to building byelaws - Provisions of National Building code - Conventional Representation of building materials and elements in plans and sections - Representations of electrical and plumbing services.
Drawing of plans, sections and elevations and sections of a single storey 1, 2 and 3- bed room residential buildings in AUTOCAD.

UNIT- III:

Sub-structure Construction: Introduction, Site clearance-Marking, Earthwork, and Foundations - Function of Foundations, Essential requirements of good foundations, Types of foundations- Open Foundations or Shallow Foundations, Raft Foundations, Deep Foundations, Well Foundations, Coffer Dams. General procedure in foundation design.

UNIT- IV:

Masonry Construction: Introduction, **Stone Masonry**: Elevation, sectional plans and cross sections of walls of Ashlar, CRS I and II sort and RR stone masonry
Brick Masonry: Plan and isometric view of external main wall junctions, Stretcher Bond, Header Bond; English Bond& Flemish Bond – for half brick, one & one and a half brick wall.
Composite Masonry: Stone Composite Masonry, Brick Stone Composite Masonry, Cement Concrete Masonry, Hollow Clay tile Masonry, Reinforced Brick Masonry.

UNIT- V:

Super-structure Construction: Reinforced Concrete Framed structure – Introductory concepts, Types of roofs, beams, columns, and stairs.
Different types of roof trusses. Formwork –Shuttering for Beams, Columns, slabs and stairs.

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Text Books:

1. S.P. Arora & S. P. Bindra, "*A text book of Building Construction*", Dhanpat Rai Publications, 2010.
2. B.C Punmia, Ashok Kumar Jain &Arun Kumar Jain “*Building Construction*”, Laxmi Publications (P) LTD, 2016.

Suggested Reading:

1. P.C. Varghese, “*Building construction*” PHI, 2016.
2. CBRI Roorkee, "*Advances in Building Materials and construction*".
3. Sushil Kumar, "*Building Construction*", Standard Publishers, 1992.
4. National Building Code of India, 2006.

18CE C03

SOLID MECHANICS

Instruction	4(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. Understand the stress - strain behaviour of different materials and temperature stresses, statically indeterminate problems in compression and tension.
2. Analyze the statically determinate beams and sketch shear force and bending moment diagrams,
3. Comprehend compound stresses, direct and bending stresses in beams.
4. Analyze thin and thick cylinders for fluid pressure and /or shrink fit pressures.

Course Outcomes: At the end of the course the students are able to

1. Evaluate the strength of various Civil Engineering materials, against structural actions such as compression, tension, shear and bending.
2. To analyze statically determinate beams and sketch SFD and BMD.
3. To suggest suitable material and sections from among the available, for use in Civil Engineering context.
4. To evaluate the behaviour and strength of Civil Engineering materials under the action of compound stresses and thus understand failure concepts.
5. To design thin and thick cylinders for resisting internal and external pressures.

UNIT- I:

Simple Stresses and Strains: Various types of stresses and strains. Hooke's law, Modulus of Elasticity, Stress-Strain curve for ductile & brittle materials, Working stress and factor of safety. Deformation of bars of uniform, varying and tapering sections under axial loads, Elongation of bars due to self weight, Bars of uniform strength, Compound bars and temperature stresses. Statically indeterminate problems in tension and compression.
Elastic Constants: Poisson's ratio, volumetric strain and derivation of relationship between elastic constants.

UNIT- II:

Shear force and Bending moment: Different types of beams and loads, Shear force and bending moment diagrams for cantilever, and simply supported beams with and without over hangs subjected to different kinds of loads viz, point loads, uniformly distributed loads, uniformly varying loads and couples- Relation between loading, shear force and bending moments.

UNIT- III:

Bending stresses in Beams: Assumptions in theory of simple bending- Derivation of bending equation, Moment of resistance -Calculation of stresses in statically determinate beams for different loads and different types of structural sections.
Shear stresses in Beams: Equation of shear stress, shear stress distribution across rectangular, circular, triangular, I, T, and diamond sections.

UNIT- IV:

Direct and bending stresses: Basic concept, Eccentric loading, limit of eccentricity - core of sections-rectangular, circular, solid and hollow sections.
Compound Stresses and Strains: Stresses on oblique planes, principal plane and principal stresses. Ellipse of stress and Mohr's circle of stress.

UNIT- V:

Thin cylinders: Thin cylinders subjected to internal fluid pressure, volumetric change, Wire winding of thin cylinders.
Thick cylinders: Lame's equations, stresses under internal and external fluid pressures. Compound cylinders-shrink fit pressure.

Text Books:

1. B. C. Punmia," *Mechanics of Materials*", Laxmi publishers, Delhi, 2017.
2. S. Ramamrutham, "*Strength of Materials*", Dhanpat Rai & Sons, Delhi, 2014.

Suggested Reading:

1. S.B. Junnarkar, "*Mechanics of structures (Vol-I &Vol-II)",* Charotar Publishing house, 2016.
2. D.S. Prakash Rao, "*Strength of Materials-A Practical Approach*", Universities Press, 1999.
3. E.P. Popov, "*Engineering Mechanics of solids*", Pearson, 2015.
4. G.H. Ryder, "*Strength of Materials*", 3rd Edition in SI units, Macmillan India Ltd, 1969.
5. A. Pytel and F.L. Singer, "*Strength of Materials*", Harper & Row, 4 Edition, New York, 1999.

18CE C04

SURVEYING AND GEOMATICS

Instruction	(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student to

1. Understand the basics of Surveying
2. Know and read the topo sheets.
3. Use the topo sheets for taking appropriate decisions.
4. Expose to various Surveying instruments.
5. Develop the maps required for various applications accurately.

Course Outcomes: At the end of the course the student is able to

1. Know the estimation of various parameters required for execution of a project.
2. Be in a position to choose appropriate instruments for carrying Surveying.
3. Can identify the data required for preparation of topo sheets.
4. Acquiring the data accurately and quickly with proper checks.
5. Knows the way of transferring data from topo sheets to ground and vice versa.

UNIT- I:

Introduction to Surveying :Principles and objectives of surveying, Linear, angular and graphical methods, concept of Survey stations, Survey lines- ranging, brief introduction to offsets-types and uses; Bearing of survey lines using prismatic compass, concepts of whole circle bearing system and quadrantal bearing system.

Levelling: principles, terms used in levelling, bench marks and types, booking and reduction of levels, types of levelling; contouring: Contours- definition, contour interval, characteristics, methods of contouring and interpolation and uses of contours, estimation of areas and volumes using Trapezoidal and Simpson's method.

Plane table surveying: concepts, methods of plane table surveying.

Triangulation and Trilateration: Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Trigonometric levelling - Axis signal correction.

UNIT - II:

Curves: Elements of simple and compound curves – Method of setting out, Elements of Reverse curve, Transition curve – length of curve – Elements of transition curve, Vertical curves-types, setting out of vertical curves-tangent correction method and chord gradient method.

UNIT - III:

Modern Field Survey Systems: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Diatomite, Total station-Parts of a Total Station – Accessories, Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey-concepts of consecutive coordinates- Total coordinates-balancing of traverse-Plotting of traverse.

Global Positioning: Systems- Segments, GPS measurements, errors and biases, surveying with GPS, Co-ordinate transformation, accuracy considerations.

UNIT - IV:

Photogrammetric Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial Photogrammetric, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.

UNIT - V:

Remote Sensing: Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors.

Visual image interpretation: introduction, fundamentals of visual image elements, image interpretation strategies and keys, wavelength of sensing, temporal aspects of image interpretation. Introduction to types of digital image processing.

Text Books:

1. Subramanian,"
2. *Surveying and Levelling*", Oxford Higher Education, 2012.
3. K. R. Arora, "*Surveying, Vol-I, II and III*", Standard Book House, 2015.
4. GopiSatheesh and R.Sathikumar, "*Advanced Surveying: Total Station, GIS and Remote Sensing*", Pearson India, 2006.

Suggested Reading:

1. K. Manoj K. Arora and R. C. Badjatia*," Geomatics Engineering*", Nem Chand & Bros, 2011
2. A. M. Chandra, "*Higher Surveying",* Third Edition, New Age International (P) Limited, 2002.
3. M. Anji Reddy, "*Remote sensing and Geographical information system*", B.S. Publications, 2001.

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18CE C05

FLUID MECHANICS

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of this course is

1. To introduce the concepts of fluid mechanics and fluid properties useful in Civil Engineering applications.
2. To understand fluid pressure and forces, pressure measuring devices and stability of floating bodies.
3. To understand the fluid motion, energy equation, analyze the forces on various objects.
4. To know various measuring instruments in finding the fluid velocity, and discharge in pipe and channel flow. To understand dimensional analysis, model and prototype and models applied to practical applications.
5. To understand and analyze different flow characteristics of laminar and turbulent flow.

Course Outcomes: At the end of the course, the student will be able to

1. Apply fluid flow concepts and evaluate the various properties of fluid.
2. Use of pressure gauges, design hydraulic gates.
3. Apply the continuity, momentum and energy principles in hydraulic applications.
4. Measure velocity and Discharge of fluid flow in pipes, channels, and tanks. Apply model studies to practical applications.
5. Quantify losses and design pipes

UNIT – I:

Basic Concepts and Fluid properties: Distinction between a fluid and a solid, conservation principles applied in fluid mechanics, ideal fluid, real fluid, fluid continuum, density, specific weight, specific gravity, dynamic viscosity, kinematic viscosity, variation of viscosity with temperature, Newton law of viscosity; vapour pressure, surface tension, cohesion, adhesion, capillarity, bulk modulus of elasticity and introduction to compressible fluids.

UNIT – II:

Fluid Statics: Fluid pressure-pressure at a point, Pascal's law, pressure variation, absolute and gauge pressure, piezometer, u-tube manometer, single column manometer, u-tube differential manometer, inverted u-tube differential manometer, pressure gauges-bourdon's pressure gauge, hydrostatic pressure and force-horizontal, vertical, inclined and curved surfaces. Buoyancy, metacentre, metacentric height and stability of floating bodies.

UNIT – III:

Fluid Kinematics: Classification of fluid flow-steady and unsteady flow; uniform and non-uniform flow, laminar and turbulent flow, rotational and irrotational flow, compressible and incompressible flow, one, two and three dimensional flows, stream line, path line, streak line and stream tube, stream function, velocity potential function, flow net, three -dimensional continuity equations in Cartesian coordinates.

Fluid Dynamics: Forces causing motion, equations of motion - Euler's equation, Bernoulli's equation-derivation, momentum principle, forces exerted by fluid flow on pipe bend, impact of jets-force exerted by a liquid jet on a stationary, moving flat plate and curved vanes.

UNIT – IV:

Measurement of Velocity and Discharge: Pitot tube, and current meter, measurement of discharge in pipes and tanks: venturimeter, orifice meter, flow through mouthpiece and orifice. Measure discharge in free surface flows: notches and weirs.

Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity, Rayleigh method, Buckingham's π-Theorem method, dimensionless groups, dimensionless numbers, similitude, model studies, types of models, scale effect in models, application of Reynold's and Froude's model laws.

UNIT – V:

Flow through Pipes: Loss of head through pipes, major loss-Darcy's Weisbach equation, minor losses, total energy equation, hydraulic gradient line, pipes in series, equivalent pipes, pipes in parallel, power transmission through pipes, water hammer in pipes and control measures.

Text Book:

1. P. N. Modi and S. M. Seth, "*Hydraulic and Fluid Mechanics*", Standard Book House, Delhi, 2013.
2. Victor Streeter and E. Benjamin Wylie, "*Fluid Mechanics*", Mc-Graw Hill, Newyork, 2017

Suggested Reading:

1. K.L. Kumar, "*Engineering Fluid Mechanics",* S. Chand, , Delhi, 2010.
2. Frank M. White, "*Fluid Mechanics*", Mc-Graw Hill, Newyork, 2011.
3. Yunus A. Cengel& John M. Cimbla, "*Fluid Mechanics Fundamentals and Applications*", Tata Mc Graw Hill Education private Ltd, 2012.

18EG M01

INDIAN CONSTITUTION

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: The course will introduce the students to

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: After successful completion of the course the students will be able to

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right To Liberty.

Unit-I:

Constitution of India: Introduction and salient features .Constitutional history.
Directive Principles of State Policy - Its importance and implementation.

Unit -II:

Union Government and its Administration: Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States.
Parliamentary form of government in India. President: role, power and position.

Unit- III:

Emergency Provisions in India: National emergency, President rule, Financial emergency

Unit- IV:

Local Self Government: District's Administration Head: Role and Importance.
Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
Panchayati Raj: Introduction, ZillaPanchayat, Elected officials and their roles, CEO ZillaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

Unit- V:

Scheme Of The Fundamental Rights and Duties: Fundamental Duties - the legal status.
Scheme of the Fundamental Rights - To Equality, to certain Freedom under Article 19, to Life and Personal Liberty under Article 21.

Suggested Reading:

1. **"***The Constitution of India***"**, 1950 (Bare Act), Government Publication.
2. S. N. Busi S. N., Ambedkar B. R, "*Framing of Indian Constitution***"**, 1st Edition,2015.
3. Jain M. P., "*Indian Constitution Law"*, 7th Edn., Lexis Nexis,2014.
4. Basu D. D**, "***Introduction to the Constitution of India",* Lexis Nexis,2015.

18EE A01

INDIAN TRADITONAL KNOWLEDGE

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: To enable the student

1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Course Outcomes: After completion of this course, students will be able to:

1. Understand philosophy of Indian culture
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras.

UNIT-I:

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II:

Indian Languages, Culture and Literature:

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III:

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV:

Fine arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT-V:

Education system in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. KapilKapoor, "*Text and Interpretation: The India Tradition*", ISBN: 81246033375, 2005
2. "*Science in Samskrit*", Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. Narain S., "*Examinations in ancient India*", Arya Book Depot, 1993
4. Satya Prakash, "*Founders of Sciences in Ancient India*", Vijay Kumar Publisher, 1989
5. M. Hiriyanna, "*Essentials of Indian Philosophy*", MotilalBanarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Reading:

1. KapilKapoor,"*Language, Linguistics and Literature: The Indian Perspective*", ISBN-10: 8171880649, 1994.
2. Karan Singh, "A Treasury of Indian Wisdom: An Anthology of Spiritual Learn", ISBN: 978-0143426158, 2016.

18CE C06

SURVEYING AND GEOMATICS LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	35 Marks
CIE	15Marks
Credits	1

Course Objectives: To enable the student

1. To know the use of simple survey instruments in the field.
2. To develop topo maps from the field data.
3. To get exposure to modern surveying instruments for solving the problems
4. To understand the concepts of automation in surveying.
5. To be in a position to set the curves by using various methods and identifying the data required to be computed for the same.

Course Outcomes: At the end of the course the student should have learnt

1. To use simple as well as modern surveying instruments.
2. To develop L.S and C.S for road works, Canal works, using Auto levels and to develop contour map of the given area.
3. To use Total Station for locating ground details and plotting.
4. To set simple curves using Total Station.
5. To locate ground features using GPS.

LIST OF EXPERIMENTS:

1. Ranging, running perpendicular lines and types of offsets by using chain, tape, cross staff.
2. Use of prismatic compass for measuring the area of a given land by using compass traverse.
3. Introduction to plane table work. - Radiation and intersection methods.
4. Introduction to levelling - Fly levelling using Auto level.
5. Development of L.S. and C.S after obtaining levels by using Auto levels.
6. Developing contour maps.
7. Measurement of horizontal angles using theodolite.
8. Study of Total station operations.
9. Traversing by Total station.
10. Setting of simple curve with the help of Total Station.
11. Study of GPS operations.
12. Establishing control points using GPS.
13. Demonstration of Remote Sensing Data processing software

Suggested Reading:

1. B. C. Punmia and A. K. Jain," *Surveying and Levelling"*, *Vol. I and II*, Laxmi Publications, 2016.
3. Subramanian, *"Surveying and Levelling*", Oxford Higher Education, 2012.

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Department of Civil Engineering

18CE C07

FLUID MECHANICS LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	35 Marks
CIE	15Marks
Credits	1

Course Objectives: To enable the student

1. To enable the student to understand the governing parameters for the discharge measurement for flow through pipes, channels and tanks.
2. To enable the student to understand viscosity.
3. To understand flow visualization, Energy and Momentum principles by conducting experiments.
4. To understand stability of floating bodies by conducting experiments.
5. To understand Hydrostatic forces on flat and curved surfaces by conducting experiments.

Course Outcomes: At the end of the course, the student should have learnt

1. Ability to find the coefficient of discharge for flow through pipes, channels and tanks.
2. To differentiate between viscous and non-viscous flows and identify the governing parameters for both.
3. Applies the concept of energy and momentum principles.
4. Ability to find the stability and metacentre of floating body.
5. Applies the concept of hydrostatic forces on flat and curved surfaces.

List of experiments (Max 10 to be conducted):

1. Measurement of viscosity
2. Stability of Floating Body
3. Hydrostatics Force on Flat Surfaces/Curved Surfaces
4. Verification of Bernoulli's Theorem
5. Venturimeter
6. Orifice meter
7. Impacts of jets
8. Flow Visualization
9. Determination of C_d for mouthpiece (constant Head method).
10. Determination of C_d for V notch.
11. Determination of C_d of a mouth piece for unsteady flow in a hemi – spherical tank.

Suggested Reading:

1. N. Kumara Swamy, "*Fluid Mechanics and Machinery Laboratory Manual*", Charotar Publishing House Pvt. Ltd., Anand, Gujarat, 2008.
2. Sarbjit Singh, "*Experiments in Fluid Mechanics*", PHI Learning Private Limited, New Delhi, 2012.

18CS C05

BASICS OF DATA STRUCTURES
(Common for other Programmes except CSE& IT)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	20 Marks
Credits	2

Pre-requisites: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives: To introduce
1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different sorting and searching techniques and their complexities.

Course Outcomes: The Student will be able to
1. Understand the basic concepts of data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Choose and apply an appropriate data structure for a specified application.
4. Understand the concepts of recursion and its applications in problem solving.
5. Demonstrate a thorough understanding of searching and sorting algorithms.

UNIT – I:

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff.

Recursion: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT – II:
Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

UNIT – III:
Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications.

UNIT – IV:
Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT – V:
Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.
Searching and Sorting: Linear searching, binary Searching, sorting algorithms- bubble sort, selection sort, quick sort, heap sort.

Text Books:

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1. Narasimha Karumanchi, "*Data Structures and Algorithms Made Easy*", Career Monk Publications, 2017
2. Horowitz E, Sahni S., and Susan Anderson-Freed," *Fundamentals of Data structures in C*", Silicon Pr; 2 edition (1 August 2007)
3. ReemaThareja, "*Data Structures using C*", Oxford, 2014.

Suggested Reading:

1. Kushwaha D. S. and Misra A. K, "*Data structures A Programming Approach with C"*, PHI.
2. Seymour Lipschutz," *Data Structures with C*", McGraw Hill Education, 2017.

Online Resources:

1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data-structures-1#DS

18CE C08

HYDRAULIC ENGINEERING

Instruction	4(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of this course is

1. To understand and analyze the laminar and turbulent flow.
2. Exposure to the basic principles of Aerodynamic forces, boundary layer.
3. Understand and analyze the open channel flows, steady uniform flow and computation.
4. Understand and analyze the non-uniform flows and flow profile, energy dissipation.
5. Familiarize with hydraulic machinery and its design, understand performance of hydraulic machinery.

Course Outcomes: At the end of the course, the student will be able to

1. Analyze the fluid effect related to laminar and turbulent flow in pipes.
2. Interprets the basics of computation of drag and lifts forces in the field of aerodynamics, boundary layer effect.
3. Apply the concepts of open channel flow and design the efficient channel.
4. Apply the concepts of non-uniform open channel flow to the field problems.
5. Design the turbines and pumps, should be able to run the turbines and pumps for efficient conditions.

UNIT – I:
Laminar Flow and Turbulent Flow: Laminar Flow: Laminar flow through circular pipes, annulus and parallel plates, measurement of viscosity. Turbulent Flow-Reynolds experiment, transition from laminar to turbulent flow, definition of turbulence, scale and intensity, causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes.

UNIT – II:
Boundary Layer Analysis, **Drag and Lift**: Boundary Layer Analysis-Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum and energy thickness, laminar and turbulent boundary layers on a flat plate, laminar sub-layer, smooth and rough boundaries, local and average friction coefficients, separation and control.
Drag and Lift: Fundamental concepts of drag and lift forces, Magnus effect, drag on sphere, cylinder, flat plate and aerofoil.

UNIT – III:
Introduction to Open Channel Flow and Uniform Flow: Introduction to Open Channel Flow: Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channel flow, velocity and pressure distribution of channel section.
Uniform Flow: Continuity equation, energy equation and momentum equation, characteristics of uniform flow, Chezy's formula, Manning's formula, factors affecting Manning's roughness coefficient, most economical section of channel, computation of uniform flow, normal depth.

UNIT- IV:
Non-Uniform Flow and Hydraulic Jump: Non-Uniform Flow-Specific energy, specific energy curve, critical flow, discharge curve, critical depth. channel transitions, measurement of discharge and velocity –venture flume, standing wave flume, gradually varied flow-dynamic equation of gradually varied flow, classification of channel bottom slopes, classification of surface profile, characteristics of surface profile, computation of water surface profile-direct step method.
Hydraulic Jump: Theory of hydraulic jump, elements and characteristics of hydraulic jump in a rectangular channel, length and height of jump, location of jump, types and energy dissipation.

UNIT- V:

Hydraulic turbines and Centrifugal Pumps: Hydraulic turbines-Classification, specific speed, unit quantities velocity triangles, power developed and efficiencies, principles of design of reaction and impulse turbines, characteristics curves, selection of turbines. Centrifugal Pumps- Components, work done and efficiency, minimum starting speed, Euler head equation, specific speed and characteristic curves of centrifugal pumps.

Text Books:

1. P. N. Modi and S. M. Seth, "*Hydraulic and Fluid Mechanics*", Standard Book House, Delhi, 2013.
2. K. Subramanya, "*Flow in Open Channels*", Tata McGraw-Hill Education, 2009.

Suggested Reading:

1. K. Subramanya, "*1000 Solved Problems in Fluid Mechanics*", Tata Mc-Graw Hill Publications 2005.
2. Ven Te Chow, "*Open-Channel Hydraulics",* McGraw-Hill, New York, 1959.

18CE C09

REINFORCED CONCRETE DESIGN – I

Instruction	4(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The student is able to
1. Understand general mechanical behavior of reinforced concrete, design philosophies, design requirements get introduced to IS: 456 code and working stress method of design applied to RC rectangular beams.
2. Understand the basic principles of Limit state design, assumptions made in theory of flexure and flexural design procedures for singly reinforced and doubly reinforced rectangular beam.
3. Grasp the fundamentals of analysis and design of rectangular beams for shear and torsion, checking for bond and applying serviceability check for beams.
4. Know the procedures for analysis and design of one-way simply supported and cantilever slabs and two-way simply supported and continuous slabs.
5. Learn the design and detailing of columns and footings of rectangular and circular sections.

Course Outcomes: At the end of the course, student is able to
1. Use and suggest Reinforced concrete for various practical applications, interpret the clauses of IS:456 and apply the working stress method of design for rectangular beams.
2. Design RC beams of rectangular and flanged sections/ for flexure using limit state method.
3. Design RC beams for shear and torsion and check for bond and serviceability.
4. Analyze and design solid rectangular RC slabs of one way (cantilever, simply supported and continuous) and two way (simply supported and continuous).
5. Design RC columns (short and long) and axially loaded footings of circular and rectangular sections.

UNIT - I:
Introduction to Reinforced Cement concrete: Concept of reinforced concrete - basic requirement of RC structures- Stresses, loads & combinations- Design Philosophies: Development of design philosophies - working stress method - Ultimate load method - Limit state method - Merit and demerits. Introduction to IS: 456- General design requirements and specifications. Working Stress method: Assumptions made in design of flexural members – Theory of bending in RC beams - Balanced, under and over reinforced sections. Analysis and design for flexure of singly and doubly reinforced rectangular beams-Analysis and design T-beams using WSM.

UNIT- II:
Limit state method of design: Introduction to limit state method - classification of limit states – characteristic loads - partial safety factors – Factors for material and load - design stress – stress and strain diagram of concrete and steel - Assumptions made in design of flexural members - Stress block parameter - Analysis and flexural design of singly reinforced, doubly reinforced rectangular beams and flanged beams.

UNIT - III:
Limit state of collapse in shear and torsion: Types of shear reinforcement – analysis and design for shear and torsion in beams - Bond - development length and curtailment of reinforcement in beams and detailing of bars: IS a code provision. Limit state of serviceability: Short term, long term, total deflection - check for deflection - cracking - IS code provisions.

UNIT - IV:
Analysis and design of slabs: Solid rectangular slabs - cantilever slab – simply supported and cantilever one way and two way slabs subjected to uniformly distributed loads - IS code method of design of these slabs - Detailing of reinforcement and check for serviceability in slabs. Design of stair: Design and detailing of dog legged slab type staircase.

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UNIT - V:

Analysis and design of columns: Short and long columns - End conditions- effective length of columns assumptions made in design - analysis - design and detailing of axially loaded square, rectangular and circular columns with lateral ties and helical bar - Design of axially loaded short columns subjected to uni-axial and bi-axial moments , using interaction diagrams – design principles for long columns. Footings: Types of Foundations and IS Specifications, Design and detailing of isolated rectangular and circular footings for axial loads.

Text Books:

1. N. Subramanian, "*Design of Reinforced Concrete Structures*" Oxford University Press. First Published in 2013, Second impression 2014.
2. S. Unni Krishnan Pillai and Devadas Menon, "*Reinforced Concrete Design*", Tata McGraw-Hill Publishing Co Ltd, (Third Edition), 2009.

Suggested Reading:

1. V. L. Shah and S. R. Karve, "*Limit State Theory and Design of Reinforced Concrete*", Structures Publications, 7th Edition,2014.
2. A.K. Jain, "*Reinforced Concrete: Limit State Design*", Nem Chand & Brothers-Roorkee; Seventh edition, paperback – 2012.
3. Sushil Kumar, "*Treasure of RCC Designs",* Standard Book House; Edition: 19th, Year-2014 edition (1 December 2009).
4. N. Krishna Raju, "*Design of Reinforced Concrete Structures*", CBS Publishers and Distributors, New Delhi, 4th edition, 2016.

18CE C10

STRUCTURAL ANALYSIS-I

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the students

1. Comprehend the concept of determination of flexural deflections statically determinate beams using various methods.
2. Analyze the indeterminate beams.
3. Understand the behavior of circular shafts subjected to torsion and also to the combined effect of bending & torsion and compute the strain energy in bars subjected to the action of various types of loads.
4. Understand the failure behavior of compression members and the significance & analysis of types of springs.
5. Gain the knowledge on unsymmetrical bending and shear center determination in different types of sections.

Course Outcomes: At the end of the course, the student will be able to

1. Compute deflections in determinate beams, under various types of static loads, using a suitable method.
2. Analyze the indeterminate beams subjected to various types of loads.
3. Analyze & design circular shafts subjected a given torque and also to determine the strain energy in members under various loading situations.
4. Analyze various types of springs and also the columns.
5. Analyze the members subjected to unsymmetrical bending and locate shear center for different sections.

UNIT - I:

Slopes and Deflections: Determination of Slope and deflections by double integration method and Macaulay's Method for cantilever, simple supported beams and overhanging beams carrying point loads, uniformly distributed loads, uniformly varying loads and couples. Application of Moment area method and Conjugate beam method for determination of Slope and deflections in simple cases.

UNIT - II:

Propped Cantilevers: Analysis of propped cantilever beams with elastic and rigid props for point loads and uniformly distributed loads, and determination of slope and deflections.

Fixed beams: Analysis of fixed beams subjected to point loads, uniformly distributed loads, uniformly varying loads. Slope and deflections in fixed beams with and without sinking of supports.

Continuous beams: Theorem of three moments and its derivation. Analysis of continuous beams with and without sinking of supports using theorem of three moments.

UNIT - III:

Torsion: Theory of pure torsion, solid and hollow circular shafts, strength and stiffness of shafts, Transmission of power. Combined torsion and bending with and without end thrust. Determination of principal stresses and maximum shear stresses. Equivalent Bending and Torsional Moments.

Strain energy: Strain energy, proof resilience and modulus of resilience. Strain energy in bars subjected to gradually applied loads, suddenly applied and impact loads. Strain energy due to shear, bending and torsion.

UNIT - IV:

Springs: Types of springs & significance, analysis of Closed and open coiled helical springs under axial load and twist and leaf springs.

Columns and Struts: Columns and classification, Empirical formulae Column & Struts, Failure of short, medium & slender column, Different end conditions of columns, Euler's theory for long columns. Rankine - Gordon's formula. Eccentrically loaded columns, Secant and Prof. Perry's formulae.

UNIT- V:

Unsymmetrical bending of beams: Unsymmetrical bending - Location of neutral axis, maximum stresses for rectangular section, Symmetric channel section.

Shear Centre: Shear stress, shear flow, locating of shear center for angle section, channel section and T-section, with one axis of symmetry.

Text Books:

1. B .C. Punmia, "*Strength of Materials*", Laxmi publishers, Delhi, 2011.
2. S. Ramamrutham, "*Strength of* Materials", Dhanpat Rai & Sons, Delhi, 2012.

Suggested Reading:

1. S.B. Junnarkar*," Mechanics of structures (Vol-I &Vol-II)",* Charotar Publishing house, Anand, 2002.
2. D.S. Prakash Rao, "*Strength of Materials-A Practical Approach"*, Universities Press, 1999.
3. E.P. Popov, "*Engineering Mechanics of solids*", 1993.
4. G.H. Ryder, "*Strength of Materials",* 3 Edition in SI units, Macmillan India Ltd, Delhi, 2012.
5. A. Pytel and F. L. Singer, "*Strength of Materials",* Harper & Row, 4 Editions, New York.1999.

18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: To make the students to

1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

Outcomes: At the end of the course, student will be able to understand

1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT – I:

Management: Definition of management**,** science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT – II:

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT – III:

Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT – IV:

Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT – V:

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, "*Management*", 10/e., Prentice Hall India, 2009.

2. JAF Stoner, RE Freeman and DR Gilbert, "*Management*", 6/e., Pearson Education, 2004.

Suggested Reading:

1. P.C. Tripathy and P.N. Reddy, "*Principles of Management*", Tata McGraw Hill, 1999
2. Harold Koontz and Cyril O'Donnell "*Principles of Management''*, Tata McGraw Hill, 2017

18CE M01

ENVIRONMENTAL SCIENCE

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: To enable the student

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: At the end of the course, the student should have learnt

1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT – I:

Environmental Studies: Definition, Scope and importance, need for public awareness.
Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT – II:

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT – III:

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT – IV:

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards
Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT – V:

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu," *Introduction to Environmental Science"*, B S Publications, **2004**.
2. Suresh K. Dhameja, "*Environmental Studies"*, S. K. Kataria& Sons, **2009**.

Suggested Reading:

1. C. S. Rao," *Environmental Pollution Control Engineering"*, Wiley, **1991**.
2. S. S. Dara, "*A Text Book of Environmental Chemistry &Pollution Control"*, S. Chand Limited, 2006.

18CS C06

BASICS OF DATA STRUCTURES LAB
(Common for other Programmes except CSE & IT)

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation	15 Marks
Credits	1

Pre-requisites: Any Programming Language(C)

Course Objectives: To enable the student

1. Design and construct simple programs by using the concepts of Data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills while improving their practical knowledge in data structures.
4. To strengthen the practical ability to apply suitable data structure for real time applications.

Course Outcomes: The Student will be able to

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implement non-linear data structures such as trees, graphs and its traversal techniques.
4. Implement various kinds of searching, sorting techniques.
5. Develop the suitable data structure for real world problem.

List of Experiments

1. Implementation of operations on arrays.
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of sorting techniques.
7. Case study like Banking System, Students Marks Management, Canteen Management etc.

Text Books:

1. Brian W Kernighan, Dennis Ritchie, "*The C Programming Language*", PH PTR, 2nd Edition.
2. Richard M Reese, "*Understanding and Using C Pointers*", O`Reilly, 2013.

Web links:

https://nptel.ac.in/courses/106102064/

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18CE C11

SOLID MECHANICS LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: To know and understand the mechanical characteristics of various engineering materials by conducting different tests.

1. Mechanical properties of engineering materials under different structural actions like direct tension, compression, flexure and torsion.
2. Measurement of deflections and hence there by finding elastic behaviours.
3. To assess the behaviour of steel rods under impact loads and shear.
4. To conduct and understand bendable property of steel bar.
5. To understand the working principle of equipment to determine shear force and bending moment in statically determinate beams.

Course Outcomes: At the end of the course, the students will be able

1. To determine the strength of various materials under structural actions like direct tension, compression, flexure and torsion.
2. To compute the elastic property of the materials of the determinate beams by measurement of deflections.
3. To determine the impact/ shear strength of steel specimen.
4. Conduct bend test of steel bars.
5. Determine the shear force and bending moment in determinate beams.

List of Experiments:
1. Tension Test
2. Deflection test on Simply Supported beam
3. Deflection test on Cantilever beam
4. Compression test on Concrete
5. Impact test
6. Shear Test
7. Torsion Test
8. Bend test of steel bar
9. Determination of Shear forces in beams
10. Determination of Bending moments in beams.

Suggested Reading:

1. William Kendrick Ha, "*Laboratory Manual of Testing Materials*", Bibliolife, 2009.

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18CE C12

HYDRAULIC ENGINEERING LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: To enable the student

1. To understand uniform and non-uniform flows in open channel flows.
2. To understand drag and lift of a flow around an Aerofoil and circular cylinder.
3. To enable the student to understand major and minor losses through pipes.
4. To understand the performance and efficiencies of turbine and centrifugal pump.
5. To understand the significance of viscosity and its role in laminar flow through pipes.

Course Outcomes: At the end of the course, the student should have learnt

1. Ability to compute the velocity, discharge, channel roughness coefficient, and energy loss in uniform flows and non- uniform flows.
2. Ability to find drag and lift forces and coefficients.
3. To differentiate between major loss and minor loss and find the losses.
4. Ability to construct characteristic curves and find performance, efficiency of turbine and pumps.
5. Ability to find viscosity, shear stress, velocity changes and loss in a laminar flow.

List of experiments (Max 10 to be conducted):

1. Uniform Flow
2. Venture flume
3. Hydraulic Jump
4. Laminar flow through pipes
5. Major losses
6. Minor losses in pipe
7. Pelton Wheel turbine-find efficiency and construct performance characteristics of a Pelton wheel turbine.
8. Francis Turbine-find efficiency and construct performance characteristics of a Francis turbine.
9. Kaplan Turbine-find efficiency and construct performance characteristics of a Kaplan turbine.
10. Centrifugal Pump-find efficiency and construct operating characteristic curves of a constant speed pump.
11. Studies in Wind Tunnel
12. Flow around an Aerofoil / circular cylinder

Suggested Reading:

1. N. Kumara Swamy, "*Fluid Mechanics and Machinery Laboratory Manual",* Charotar Publishing House Pvt. Ltd., Anand, Gujarat, 2008.
2. Sarbjit Singh, "*Experiments in Fluid Mechanics*", PHI Learning Private Limited, New Delhi, 2012.

18EG C03

SOFT SKILLS LAB

Instruction	2P Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The course will introduce the students to

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: After successful completion of the course the students will be able to

1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise 1:

Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.

Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)

Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise 2:

Main Topics: Advanced Group Discussion with Case studies: Dynamics of group discussion, intervention, summarizing, and modulation of voice, body language, relevance, fluency and coherence.

Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)

Writing Input: Writing with Precision - Writing Abstracts

Exercise 3:

Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.

Flipped Sessions: Mock Interviews (Video Sessions & Practice)

Writing Input: Writing to Reflect - Resume Writing

Exercise 4:

Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity

Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)

Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5:

Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.

Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)

Writing Input: Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte , “**A Course in English communication**”, Prentice-Hall of India, 2007
2. Dr. Shalini Verma, **“Body Language- Your Success Mantra**”, S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, “**The ACE of Soft Skills”,** New Delhi: Pearson, 2010
4. Van Emden, Joan, and Lucinda Becker, “**Presentation Skills for Students**”, New York: Palgrave Macmillan, 2004

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

18CE C13

TRANSPORTATION ENGINEERING

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. To understand the design concepts of the highways, the quality of the materials required for the construction of highways and different techniques used in construction of flexible and rigid pavements.
2. To know how to collect the field data for the evaluation of traffic patterns.
3. To get an idea about the concepts of designing flexible and rigid pavements.
4. To know the construction techniques of pavements
5. To Know about pavement failures and maintenance of pavements

Course Outcomes: At the end of the course, the students will be able to

1. Understand the types of highways, patterns, master plans, alignment finalization and components of highway projects.
2. Apply various IRC Standards for the Geometric design of highways.
3. Organize collection of traffic related data and analysing the data for different applications
4. Apply the design concepts to flexible and rigid pavements as per IRC standards.
5. Understand precautions required for the execution of construction of pavements as per IRC standards, pavement distress, pavement maintenance, evaluation of pavement condition and recommend suitable remedial measures.

UNIT- I:

Highway alignment: Objectives and phases of highway engineering, history of highway engineering, factors to be considered for highway alignment, engineering surveys current road project in India and concepts of master plan road pattern highway project preparation, classification as per IRC.

UNIT- II:

Geometric Design: Highway standards (IRC)- carriageway, shoulders, medians, right of way, footpaths, cycle tracks, service roads, frontage roads, sight distance, stopping sight distance, overtaking sight distance. Camber, horizontal curves, super-elevation, transition curve, extra widening, gradient, grade compensation and design of vertical curves with numerical examples.

UNIT- III:

Traffic Engineering: Objectives of traffic studies, traffic characteristics, volume, speed, density, headways and relationship among them. Traffic volume studies, speed and delay studies, parking and accident studies. Intersection delay studies, highway capacity and level of service concept as per HCM 2000, origin and destination studies, intersection improvement studies at grade, and types of grade separated intersections, channelization, rotary planning and design, concept of signal design.

UNIT- IV:

Pavement Design: Various properties of highway materials, pavement types, factors to be considered for pavement design, structural difference between flexible and rigid pavement design. Flexible pavement design - concept of layer theory, design wheel load, ESWL, EALF. IRC cumulative standard axles method (IRC - 37: 2018).

Rigid pavement design (IRC 58-2015): Concepts -radius of relative stiffness, Modulus of subgrade reaction and other characteristics of concrete, wheel load stresses analysis by Westergaards, temperature stresses and critical combination of stresses. Longitudinal and transverse joints, contraction joints, expansion joints, construction joints, design of dowel bars and tie bars.

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UNIT- V:

Pavement Construction and Maintenance: Construction of WBM roads and WMM roads, types of bituminous construction- interface treatment, bituminous surface dressing, seal coat, penetration macadam, built up spray grout, pre-mix methods, bituminous macadam, bituminous pre-mix carpet, bituminous concrete, bituminous sheet asphalt, mastic asphalt. Construction procedures– surface dressing, penetration macadam, built- up spray grout, bituminous bound macadam and bituminous concrete. Construction of cement concrete pavements and construction of joints.Pavement distress, failures of flexible and rigid pavements, remedial measures including maintenance.

Text books:

1. S. K. Khanna, C. E. G. Justo, and A. Veeraraghavan, "*Highway Engineering*", revised 10th Edition, Nem Chand & Bros., 2017.
2. L. R. Kadiyali, '*Traffic Engineering and transport planning'*, Khanna Publishers.2011.
3. S.K. Sharma, "principles, Practice and Design of Highway engineering", S. Chand Publishers, 2015.
4. R.Srinivas Kumar, "*Transportation Engineering*", Universities Press, 2020

Suggested Reading:

1. Fred L. Mannering and Scott S. Washburn, "*Principles of Highway Engineering and Traffic Analysis*", 4th Edition, John Wiley, 2007
2. R. Srinivasa Kumar," *Pavement Evaluation, Maintenance and Management systems*", Universities Press, 2014.
3. L. A. Garber and N. J. Hoel, K. RamachandraRao, "*Traffic and Highway Engineering*, 5th Edition, 2017. Cengage learning India Pvt. Ltd., New Delhi
4. R. Srinivasa Kumar, "Textbook *of Highway Engineering*", Universities Press, 2011.
5. Dr. L.R. Kadiyali and Dr. N.B. Lal, "Principles and Practices of Highway Engineering", Khanna Publishers, 2018.
6. IRC 37:2018, "Flexible pavement design".
7. IRC 58:2015, "Rigid pavement design".

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GEOTECHNICAL ENGINEERING

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the students

1. Understand the basic principles of soil mechanics, properties of soils and knowledge of identifying soil.
2. Understand the flow through soils and its behavior and gain a practical outlook of utilizing soil as construction materials.
3. Understand highly compressible soil settlements and estimate the strength of soil for different loading conditions.
4. Identify shear strength parameters of soil using different laboratory tests.
5. Interpret problem of earth pressures and slope stability under different field conditions.

Course Outcomes: At the end of the course, the student will be able to

1. identify various types of soils and determine their properties.
2. estimate coefficient of permeability, stresses in soils under various soil conditions and compute discharge in soil.
3. modify the properties of soil by using various compaction methods and compute the settlement of compressible soils.
4. estimate the shear strength of different soils under various loading conditions.
5. evaluate earth pressures and slope stability under different field conditions.

UNIT- I:

Physical and Index properties of soils: Introduction about origin and formation of soils, basic definitions from soil three phase diagram (weight ratios & volume ratio), Inter relationships of preliminary properties. Determination of laboratory tests for water content, field density, specific gravity by various methods, Index properties, sieve analysis, consistency limits, Indian soil classification IS-1498-1970.

UNIT- II:

Permeability of soils: Darcy's. law of seepage water through soils- Determination of co-efficient of permeability (constant head, variable head permeability tests) – Field tests (Pumping in and pumping out tests) – Equivalent permeability of stratified soils.

Stress in Soils: Total, effective and neutral stress for different soil conditions.

Seepage in Soil: Seepage flow, seepage pressure – Flow nets – Locating phreatic line in a homogeneous earthen dam using Kozeny's parabola – computation of seepage quantity.

Quick Sand Phenomena: Critical Hydraulic gradient.

UNIT- III:

Compaction: Compaction Mechanism, factors affecting compaction. Laboratory determination of compaction characteristics- standard and modified Proctor tests – IS Light and Heavy compaction tests; Field surface compaction: compaction equipment, procedure, quality control.

Consolidation: Spring Analogy, Laboratory consolidation test, calculation of void ratio, compression characters and settlement equation, differential equation for one dimensional consolidation, co-efficient of consolidation - square root & logarithm time fitting method.

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UNIT- IV:

Shear strength: Significance of Shear strength of soils – Mohr-Coulomb equation – shear parameters – Laboratory tests for determination of shear strength – Direct shear test, Tri-axial compression tests. (UU, CU and CD), Un-confined compression test, Vane shear test. Factors affecting shear strength of cohesionless and cohesive soils.

UNIT- V:

Earth pressure: States of earth pressure – Active, Passive and at rest condition; Rankine's theory; computation of active and passive earth pressure in cohesionless (ø)& Cohesive (c) soils and c-ø soils; Coulomb's Wedge theory; Rebhann's graphical solution.

Slope stability: Definition and classification of slopes – types of slope failures- Factors of safety with respect to cohesion, angle of shearing resistance, Height – Analysis of stability of slope using Swedish slip circle method and Taylor's stability number.

Text Books:

1. K. R. Arora, "Soil Mechanics and Foundation Engineering", Standard Publisher Dist.; 7th Edition, 2009
2. B. C. Punmia, A. K Jain, and A. K. Jain "Soil Mechanics and Foundations", Laxmi Publications; Sixteenth edition, 2017.

Suggested Reading:

1. R. F. Scott, "Principles of Soil Mechanics", Wesley Educational Publishers Inc., 1st edition, 1963.
2. T. W. Lambe and R. V. Whitman, "Soil Mechanics", Wiley; 1 edition, 2012.
3. GopalRanjan, "Basic and Applied Soil Mechanics", New Age International Pvt Ltd; Third edition 2016.
4. C.Venkatramaiah, "Geotechnical Engineering", New Age Publications, revised Fifth edition, 2017.
5. B. M. Das and K. Sobhan, "Principles of Geotechnical Engineering", NPTEL study material.
6. IS 2720-11: Methods of test for soils, Part 11: Determination of the shear strength parameters of a specimen tested in unconsolidated undrainedtriaxial compression without the measurement of pore water pressure..

18CE C15

STRUCTURAL ANALYSIS – II

Instruction: 3L Hours per week
Duration of Semester End Examination: 3 Hours
Semester End Examination: 70 Marks CIE: 30 Marks
Credits: 3

Course Objectives: To enable the student

1. Understand the concept of drawing influence line diagrams (ILDs), for reactions, shear force and bending moment in determinate beams for various loads.
2. Grasp the procedure of constructing influence line diagrams for different truss girders under various types of loads and to find maximum forces in the members of trusses. Understand the concept of determining, deflections in determinate trusses and rigid jointed frames, by Castigliano's theorem –I and unit load method.
3. Gain the knowledge of analyzing three hinged arches for point loads and uniformly distributed loads. Know the concept and analysis of cables and suspension bridges with three hinged stiffening girder.
4. Know how to analyse continuous beams without and with sinking of supports by using slope displacement, moment distribution and Kani's method.
5. Know how to analyse rigid jointed plane frames without and with sway by using slope displacement, moment distribution and Kani's method.

Course Outcomes: At the end of the course, the student will be able to

1. develop the ILD's for reactions, shear force and bending moment at a section, determine the maximum SF and BM for various positions of the moving point loads and uniformly distributed loads.
2. construct the ILD's for forces in the members of trusses and evaluate the maximum forces for various positions of the moving point loads and uniformly distributed loads.
determine the deflections of determinate truss joints by Castigliano's theorem - I and unit load method.
3. analyze three hinged arches for point loads and uniformly distributed loads. analyze cables and suspension bridges with three hinged stiffened girder.
4. apply slope deflection, moment distribution, and Kani's methods for indeterminate beams with and without sinking of supports subjected to point loads and udl on the entire span.
5. analyze rigid jointed plane frames with and without lateral sway using slope deflection, moment distribution, and Kani's methods subjected to point loads and udl on the entire span.

UNIT– I:
Moving loads: Influence line diagrams for support reactions, shear force and bending moment for a simply supported beam/girder. Determination of maximum values of support reactions, shear force and bending moment at any section for various moving load systems on simply supported beam/ girder. Curves of maximum shear force and bending moment for simply supported girders traversed by (i) single point load, (ii) two point loads (iii) uniformly distributed load longer than the span, and (iv) uniformly distributed load shorter than the span. Focal length, enveloping parabola and EUDL

UNIT– II:
Moving loads on truss girders: Influence lines for forces in the members of statically determinate trusses like Warren truss, Pratt truss, and Curved flange trusses. Determination of maximum forces in truss members due to moving point loads and uniformly distributed loads. Counter bracing.

Deflections of Determinate trusses: Deflections of truss joints using Castigliano's theorem –I and Unit load method.

UNIT– III:

Three hinged arches: Three hinged parabolic and segmental arches, determination of support reactions. Bending moment, normal thrust and radial shear at a section subjected to point loads and uniformly distributed loads. Influence line diagrams for horizontal thrust, bending moment, normal thrust and radial shear.

Cables and Suspension bridges: Stresses in suspended cables due to point loads and uniformly distributed loads, equation of the cable, length of cable and general cable theorem. Suspension bridge with 3-hinged stiffening girders for static loading, determination of maximum tension in the cable, bending moment and shear force in the girder.

UNIT- IV:

Indeterminate beams: Analysis of Indeterminate beams with and without sinking of supports using slope deflection, moment distribution, and Kani's methods. Loading on each span may be point load(s) and uniformly distributed load on whole span. Shear force and bending moment diagrams.

UNIT- V:

Indeterminate rigid jointed plane frames: Analysis of rigid jointed plane frames with and without lateral sway using slope deflection, moment distribution, and Kani's methods. Loading on each span may be point load(s) and uniformly distributed load on whole span. Shear force, axial force and bending moment diagrams.

Text Books:

1. B.C Punmia, and A. K. Jain, "SMTS - II Theory of Structures", Laxmi Publications, New Delhi, 2017.
2. S. Ramamrutham, "Theory of Structures", Khanna Publishers, New Delhi, 2018.

Suggested Reading:

1. H. J. Shah, S. B. Junnarkar, "Mechanics of Structures Vol. II [Theory and analysis of structures]", 24th Edition, Charotar Publishing House Pvt. Ltd., 2015.
2. T. S. ThandavaMoorthy, "Structural Analysis", 2nd edition, Oxford University Press, 2012.
3. C. S. Reddy, "Basic Structural Analysis", 3rd Ed., Tata McGraw Hill, New Delhi, 2017.
4. D. S. PrakashRao, "Structural Analysis" - A Unified Approach, University Press, 2012

18CE E01

PRESTRESSED CONCRETE
(Core Elective –1)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student to,
1. Understand the basic principles and structural behaviour of pre stressed concrete with reference to IS 1343 code
2. Equip the students with a thorough understanding of the behaviour and analysis of PSC beams.
3. Understand and apply the design principles of PSC beams in flexure and shear.
4. Understand the concepts of various stresses in anchorage zone.
5. Identify the advantages of continuous beams and can analyse for primary and secondary moments.

Course outcomes: At the end of the course, Students will be able to
1. understand the general mechanism of pre stressed concrete members, types of pre stressing
2. Analyze the behaviour of pre stressed concrete beams.
3. Identify and apply design concepts for the pre stressed concrete beams under flexure and shear.
4. analyze the stresses in anchorage zones and design the end anchorages.
5. understand the fundamental concepts of primary and secondary moments in continuous beams.

UNIT- I:General Principles of Pre Stressed Concrete:
Introduction: Basic concepts – Materials - Permissible stresses – Advantages – pre-tensing and post tensing – Pre Stressing by Straight Concentric, Eccentric bent and Parabolic Tendons – Different methods of Pre stressing – Hoyer System – Freyssinet system – Magnel-Blaton system – Lee Mecal system – Use of IS 1343 code, concepts of precast and post tensioned elements.

UNIT – II: Analysis, Losses and Deflection of PSC beams:
Analysis of sections for pre stress and flexure for Straight Concentric, Eccentric, Bent and Parabolic Tendons. Pressure Line – Cable Profile
Losses of Pre stress: Losses in P.S.C. members due to elastic shortening – Shrinkage – Creep in Concrete – Relaxation of Steel – Slip in anchorage – Frictional Loss – Computation of losses.
Deflections of P.S.C members: Importance of deflections - factors influencing deflections, short term and long term deflections – IS code requirements for Maximum deflections – Computation of short term deflections due to pre stressing force – Dead and Live loads.

UNIT – III:Design of Section for Flexure and Shear :
Allowable stresses – Elastic Design and Limit state method of Design of Rectangular – I Section beams for Flexure – Check for ultimate flexural strength as per – IS 1343 Codal Provisions. Design of Section for Shear: Shear and principal stresses – Cracked and uncracked sections – Codal provisions – Ultimate shear resistance – Design of shear reinforcement in beams.

UNIT – IV:Anchorage Zone stress in Post tensioned members:
Stress distribution in End block – Analysis by Magnel and Guyon'smethods – IS 1343 code provisions – Bursting Tensile force – Design of anchorage zone reinforcement.

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UNIT – V:Continuous beams:
Advantage and Disadvantages - Primary and Secondary moment – P and C- lines – Liner transformation , Concordant and Non concordant cable profile - Analysis of Continuous beams.

Text Books:
1. N. Krishna Raju ,"Prestressed Concrete" , Tata McGraw Hill,2018
2. G.S. Pandit and S.P. Gupta, "Prestressed Concrete", CBS Pub., 2009.

Suggested Reading:
1. Arthur H. Nilson, by"Design of Prestressed Concrete", John Wiley 1987.
2. T.Y Lin and Burn," Design of prestressedConcrete",Wiley India Private Limited, 2010. 52 53 18CE

18CE E02

GREEN BUILDING TECHNOLOGIES
(CoreElective –1)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: To enable the student
1. To understand the basic concepts of green building technologies and their significance.
2. To understand the judicial use of energy and its management.
3. To know about the Sun-earth relationship and its effect on climate.
4. To enhance awareness of end-use energy requirements in the society.
5. To know about the suitable technologies for energy management and audit procedures.

Course Outcomes: At the end of the course, the student will be able to
1. relate the fundamentals concepts of green buildings, identify the energy use & its management and recall some prominent green buildings in india.
2. understand the indoor environmental requirement and choose appropriate materials and finishes.
3. apply the knowledge about sun-earth relationship vis-a-vis its effect on climate and understand the energy impact on the shape and orientation of buildings.
4. estimate lighting and heat energy requirements and evaluate their end use.
5. understand the various concepts of energy audit, judge the buildings for green certifications and develop a green building as per the standards.

UNIT- I:
Introduction to green buildings- Barriers and benefits of Green Building- Characteristics of energy use, energy process and its management - Macro aspect of energy use in dwellings and its implications- Site and landscape planning for Green Building Construction- Prominent Green Buildings in India and their features.

UNIT- II:
Indoor environmental requirement and management: Thermal comfort– Ventilation and air quality– Air-conditioning requirement- Visual perception– Illumination requirement- Auditory requirement- Green Building materials and finishes- emittance levels.

UNIT- III:
Climate, solar radiation and their influences: Sun- Earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature– Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT- IV:
Energy utilization and requirements: Lighting and day lighting– End use energy requirements- Status of energy use in buildings Estimation of energy use in a building- Heat gain and thermal performance of building envelope- Steady and non-steady heat transfer through the glazed window and the wall- Standards for thermal performance of building envelopes- Evaluation of the overall thermal transfer.

UNIT- V:
Energy management systems: Energy audit and energy targeting – Technological options for energy management.
Certification- Study of LEED and TERI (GRIHA) parameters and certification of Green Buildings.

Text Books:
1. Charles J. Kibert,"Sustainable Construction - Green Building Design and Delivery", John Wiley & Sons, New York, 2008

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2. Norbert Lechner,”Heating, Cooling, Lighting - Sustainable Design Methods for Architects”, Wiley, New York, 2015.
3. James Kachadorian, “The Passive Solar House: Using Solar Design to Heat and Cool Your Home”, Chelsea Green Publishing Co., USA, 1997.

Suggested Reading:

1. Michael Bauer, Peter Mosel and Michael Schwarz, “Green Building– Guidebook for Sustainable Architecture”, Springer, Heidelberg, Germany, 2010.
2. Mike Montoya,”Green Building Fundamentals”, Pearson, USA, 2010.
3. Regina Leffers, “Sustainable Construction and Design”, Pearson / Prentice Hall, USA, 2009.

18CE E03

PRINCIPLES OF GEOGRAPHICAL INFORMATION SYSTEMS
(Core Elective –1)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: The student is able to
1. Know the basics of GIS and its application in decision making
2. Know about various data types used in GIS
3. Realize the importance of data quality and building of GIS data base
4. Carry analysis on GIS data
5. Develop maps based on queries using GIS software's

Course outcomes: At the end of the course, the students will be able to
1. Understand the concepts and components of GIS.
2. Identify the data required to create data structure for implementation of GIS.
3. Apply the spatial and non-spatial functions for creating and editing of GIS data.
4. Choose an appropriate sequence of GIS functions for developing cartographic models.
5. Apply the knowledge of GIS in decision making by evaluation of data and find appropriate solutions to complex problems.

UNIT- I:
GIS-Introduction, definitions, components, software scenario, applications, Map- definition, elements, Projections-Definition, types, UTM, Datum - types, Coordinate system, coordinate transformations, Geoid and Ellipsoidal models.

UNIT- II:
Database management - introduction, records, fields and keys, data file and data access, database structure, database models-Hierarchical, Network, Relational database and object oriented models, Geographical data - spatial and non-spatial data, Spatial data models-Raster data-Run length coding, Block coding and Quadtree , Vector data- spaghetti data model, topological model, triangular irregular Network (TIN) data.

UNIT- III:
Development of GIS data - data input - keyboard, scanners, digitizers and images, existing data- source, concepts of Geo-referencing and selection of projections, data quality -components - positional accuracy, attribute accuracy, logical consistency, resolution, completeness, time , sources of errors- accuracy- definition, test and assumptions.

UNIT- IV:
GIS functions - organizing data for GIS analysis- Data Layers, Classification - Maintenance and analysis of spatial data-Format transformation, Geometric transformations, Geometric projections, Conflation, Edge matching, Editing and Line coordinate thinning. Maintenance and analysis of attribute- Editing and analysis functions.

UNIT- V:
Integrated analysis of Spatial and Non spatial data- Retrieval measurement and classification, Overlay, Neighborhood operations -search, Line in polygon, point in polygon, topographic functions, interpolation contour generation, Connectivity functions- contiguity, Proximity, Spread, Seek , indivisibility, Illumination, GIS output - Map Annotation, Text Labels, texture, and lines patterns. Cartographic modelling- watershed management, water resource management etc.

Text books:

1. Chor Pang Lo and Albert K.W. Yeung, "*Concepts and Techniques of Geographic Information systems*" Pearson, 2016.
2. Peter A. Burrough and Rachael A. McDowell, "*Principle of Geographical Information Systems*", Oxford University press, 1998.

Suggested Reading:

1. Michael N. Demers, "*Fundamentals of Geographic Information systems*", John Willey Publishers, 2012.
2. Stan Aronoff, "*Geographic information systems-A Management Perspective*" Environmental Systems Research Institute Inc.,U.S., 2005.
3. Kang-Tsung Chang "*Introduction to Geographic information systems*", Tata McGraw-Hill, 2015.
4. Ian Heywood, Sarah Cornelius, Steve carver, "*An introduction to Geographical information systems",* Addison Wesley Longman, 2009.

18CE E04

MASONRY STRUCTURES
(Core Elective –1)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student to understand the fundamental concepts of

1. Masonry materials and its mechanical properties.
2. Analysis and the behaviour of structural masonry
3. Shear and flexural behaviour of Reinforced and unreinforced masonry
4. Summarize construction practices, seismic behaviour, specifications ,for Design of masonry
5. Seismic evaluation and Retrofit of Masonry

Course Outcomes: At the end of the course, students will be able to

1. select an appropriate masonry unit and mortar mix for masonry construction.
2. distinguish in plane and out of plane loads and analyse for lateral forces.
3. analyse reinforced and unreinforced masonry structural elements for flexural and shear behaviour.
4. design masonry elements using working and ultimate strength design
5. understand the repairing techniques and strengthen the existing masonry structures for seismic loads

UNIT- I:
Introduction - Masonry construction - National and International perspective – Historical development, Modern masonry, Principles of masonry design, Masonry standards: IS 1905 and others.
Material Properties - Masonry units: clay and concrete blocks, Mortar, grout and reinforcement, Bonding patterns, Shrinkage and differential movements.

UNIT- II:
Masonry in Compression - Prism strength, Eccentric loading, Kern distance. Masonry under Lateral loads - In-plane and out-of-plane loads, Analysis of perforated shear walls, Lateral force distribution -flexible and rigid diaphragms.

UNIT- III:
Behaviour of Masonry - Shear and flexure - Combined bending and axial loads - Reinforced and unreinforced masonry - Cyclic loading and ductility of shear walls for seismic design – Infill masonry.

UNIT- IV:
Structural design of Masonry - Working and Ultimate strength design - In-plane and out-of-plane design criteria for load-bearing and in fills, connecting elements and ties - Consideration of seismic loads - Code provisions.

UNIT- V:
Seismic evaluation and Retrofit of Masonry - In-situ and non-destructive tests for masonry - properties - Repair and strengthening of existing masonry - structures for seismic loads.

Text Books:

1. P. Dayaratnam, "*Brick and Reinforced Brick Structures*", Oxford & IBH Publishing Co, 2017.
2. R. G. Drysdale, A. H. Hamid, and L. R. Baker, "*Masonry Structures: Behaviour& Design*", Prentice Hall Hendry, 1993.

Suggested Reading:

1. A.W. Hendry, B.P. Sinha and Davis, S. R, "*Design of Masonry Structures*", E & FN Spon, UK, 1997.
2. S. Sahlin, "*Structural Masonry*", Prentice Hall, Englewood Cliffs, NJ, 1971.
3. R.S. Schneider and W.L. Dickey, "*Reinforced Masonry Design*", Prentice Hall, 3rd edition, 1994.

18CE E05

SOLID AND HAZARDOUS WASTE MANAGEMENT
(Core Elective –2)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student
1. Understand characteristics of solid waste and legislations of solid waste management.
2. Gain insight into the transfer, transport and energy recovery from municipal solid waste.
3. Understand characteristics, handling and storage of hazardous wastes.
4. Grasp the fundamentals of site selection, remediation measures for disposal sites; contrast between hazardous waste treatment techniques.
5. Understand the concepts of Environmental Audit, Hazardous waste management legislations and toxicology principles.

Course Outcomes: At the end of the course, student is able to
1. Identify characteristics of solid waste, collection systems as per legislations.
2. List out waste reduction methods, collection techniques, resource recovery/recycling, energy recovery, transport & disposal options and select appropriate waste management facility.
3. Identify sources of hazardous waste; assess handling & storage methods based on regulations.
4. Select the site for disposal of hazardous waste; suggest treatment technologies and remediation measures for disposal sites.
5. Understand the concepts of Environmental Audit, toxicology principles; apply legislations of hazardous waste management.

UNIT- I:
Solid wastes: Solid waste generation in a technological society, sources and types of solid waste, legislations on management and handling of municipal solid wastes, monitoring responsibilities; Collection of Solid Waste: type of waste collection systems, analysis of collection system, alternative techniques for collection system.

UNIT- II:
Management of Solid waste: Separation, Processing and Transformation of Solid Waste: unit operations used for separation and processing, materials recovery facilities, waste transformation through combustion and anaerobic composting, anaerobic methods for materials recovery and treatment; Energy recovery - Incinerators. Transfer and Transport: need for transfer operation, well injections; Landfills: Site selection, drainage and leachate collection systems, requirements and technical solutions, integrated waste management facilities.

UNIT- III:
Hazardous waste: Definition and identification of hazardous wastes, sources and characteristics, hazardous wastes in Municipal Waste, Hazardous waste regulations, minimization of Hazardous Waste, compatibility, handling and storage of hazardous waste, collection and transport.

UNIT –IV:
Hazardous waste management: Treatment technologies, physical, chemical and biological treatment, Hazardous waste landfills: Site selection, remediation of hazardous waste disposal sites, quantitative risk assessment, containment, remedial alternatives.

UNIT –V:
Environmental regulations: Environmental audit, pollution prevention, facility development and operation. Hazardous waste legislations, RCRA process, superfund process; toxicological principles, dose response, toxic effects, toxic response.

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Text books:

1. P. A. Vesilind, Worrell W and Reinhart, "*Solid Waste Engineering*", 2nd Edition (2016), Cengage Learning India Pvt. Ltd.
2. Tchobanoglous,"*Integrated Solid Waste Management"*, Mc-Graw Hill International 1st Edition, New York, 2014."
3. Charles A. Wentz; "*Hazardous Waste Management*", McGraw Hill Publication, 1995.

Suggested Reading:

1. CPHEEO, "*Manual on Municipal Solid waste management"*, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.
2. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans, "*Hazardous waste Management*", Waveland Pr. Inc, 2010
3. C. A. Wentz, "*Hazardous Waste Management*", McGraw-Hill Publication, 1995.
4. A. D. Bhide and B. B. Sundaresan, "*Solid Waste Management, Collection, Processing and Disposal*", Nagpur.
5. S.C. Bhatia, "*Solid and Hazardous waste management*", Atlantic publishers, 2007.

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18CE E06

MECHANICS OF MATERIALS
(Core Elective –2)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the students

1. Understand the flexural behaviour of curved bars and determining the stresses in various cross sections.
2. Understand the behaviour of beams curved in plan, subjected to different types of loads.
3. Learn the determination of stresses in rotating discs & cylinders.
4. Realize the significance of experimental techniques in stress analysis & understand the stress analysis using brittle coating technique.
5. Comprehend the failure criteria of materials and corresponding theories of elastic failure.

Course Outcomes: At the end of the course, student will be able to

1. analyze curved bars of rectangular, circular and trapezoidal cross sections in crane hooks and chain links.
2. determine the stresses in beams curved in plan, for simply supported and fixed end conditions.
3. evaluate the stresses in rotating discs, rings and cylinders.
4. recall various brittle coating techniques, estimate the coating stresses and detect cracks.
5. apply an appropriate elastic theory of failure for the materials.

UNIT – I:

Bending of curved bars: Introduction, Bending of curved bars, stresses in curved bars with large curvature (Winkler-Bach Theory), calculation of stresses in curved bars of different sections-rectangular, circular and trapezoidal in crane hooks, and chain links.

UNIT-II:

Beams curved in plan: Introduction, circular beam loaded uniformly and symmetrically supported on columns, Semi-Circular beam simply supported on 3 equally spaced supports, cantilever quarter circular beam with a point load at free end, A fixed ended segmented curved beam.

UNIT-III:

Rotating Rings, Discs & Cylinder: Introduction, thin rotating ring or cylinder, rotating solid thin disc, rotating disc with a central hole, rotating disc of uniform strength, and rotating long cylinder.

UNIT-IV:

Stress analysis by brittle coating Technique: Introduction, Brittle Lacquers - Brittle coating techniques, Coating stresses, Theory of failure for Brittle coatings, crack patterns in brittle coating, crack detection, types of Brittle coating, Resin based brittle coating, equipment for Stress analysis by brittle coating method, specimen preparation, Testing & calibration of brittle coating .

UNIT-V:

Elastic theories of failure: Introduction - Failure by Yielding-Failure by Fracture - Yield and Fracture Criteria-Maximum Shearing Stress Theory-Maximum Distortion Energy Theory-Octahedral Shearing Stress Theory-Comparison of Yielding Theories-Maximum Principal Stress Theory- Mohr's Theory-Coulomb-Mohr Theory

Text Books:

1. V. N. Vazirani and M. M Ratwani, “Analysis of Structures Vol. 1: Analysis, Design And Details Of Structures”, Khan Publications, 2003.
2. U.C. Jindal, “Advanced Topics of Strength of Materials (PART-II)”, Galgotia Publications Pvt..Ltd. 2001.

Suggested Reading:

1. Heinemann, “Mechanics of Materials” Butterworth, 3rd edition, 1997. 2. J. O. Seely and F. B. Smith, “Advanced Mechanics of Materials”, 1967.
3. R. Subramanian, “Strength of Materials”, Oxford University press, 2016. 4. U. C. Jindal, “Strength of Materials”, Pearson Education; 2nd edition, 2017.

18CE E07

REPAIR AND REHABILITATION OF STRUCTURES
(Core Elective –2)

Instruction	3L Hours per week
Duration of Semester End	Examination 3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student to understand the fundamental concepts of
1. Maintenance and causes for distress.
2. Serviceability and durability limits.
3. Importance of structural audit and different NDT techniques.
4. Different repair materials & their suitability.
5. Various repair techniques and rehabilitation methods.

Course Outcomes: At the end of the course, the student will be able to
1. Understand the importance of maintenance & inspection and analyze the damage.
2. Find the causes of cracking & durability problems and examine the remedial measures.
3. Understand the principles of condition assessment and apply various techniques to evaluate them.
4. Choose a suitable material for a specific type of repair.
5. Identify a suitable technique for repair & rehabilitation of a structure and develop a practical solution for the problem.

UNIT – I:
Maintenance and inspection: Basic definitions of repair, retrofit, rehabilitation, strengthening and upgradation; Facets of maintenance; Planning for maintenance; Importance of maintenance, various aspects of inspection, introduction to structural auditing, NDT and NDE, structural stability and certification.
Introduction to damage mechanics: Causes of distress and damage assessment in concrete structures, Construction and design failures; Damage mechanics.

UNIT – II:
Serviceability and durability of concrete:
Deflections and deflection control, Cracks and cracks control in concrete structures, Vibrations in concrete structures. Thermal properties and cracking; Effects due to climate- Temperature, Chemical attack, Corrosion; Design and construction errors; Permeability; Effects of cover thickness and cracking.

UNIT – III:
Condition survey and NDT:
Definition and objective of condition survey, stages of conditions survey – planning, inspections and testing stages, possible defects in concrete structures; NDT techniques- rebound hammer, infra-red thermography, ground penetration technique, ultra-sonic pulse velocity test, half cell potential method and Windsor probe test, safety audit-principles and objectives, semi destructive testing– core cuttings methods.

UNIT – IV:
Materials for repair:
Special concretes and mortar- Concrete chemicals, Special elements for accelerated strength gain, Expansive cement, Polymer concrete, Sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete, Bacterial concrete,

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Rust eliminators and polymers coating for rebars during repair, Foamed concrete, Mortar and dry pack, Vacuum concrete; Carbon composites.

UNIT – V:

Techniques for repair and rehabilitation:

Guniting, shotcreting; Epoxy injection, Mortar repair for cracks, Shoring and underpinning; Methods of corrosion protection, Corrosion inhibitors, Corrosion resistant steels, Coating and cathodic protection.

Techniques for column strengthening, beam strengthening, beam to column joint strengthening using concrete, steel, FRP and carbon fibre jacketing; Addition of infill walls, shear walls and steel braces**.**

Text Books:

1. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical UK, 1991.
2. Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987.
3. B.L. Gupta and Amit Gupta, 'Maintenance and Repair of Civil Structures", Standard Publications, New Delhi, 2010.

Suggested Reading:

1. S. C. Millard and J. H. Bungey, "Testing of Concrete in Structures", Chapman and Hall, New York, 1989.
2. Barry A. Richardson, "Defects and Deterioration in Buildings", E & FN Spon Press, London, 1991.
3. A.R. Santhakumar, "Concrete Technology", Oxford University Press, New Delhi, 2006.
4. Peter H. Emmons, "Concrete Repair and Maintenance Illustrated", RS Means, John Wiley & Sons, New York, 1981.
5. W.H. Ransom, "Building Failures: Diagnosis and Avoidance", E & FN Spon Press, London, 1992.
6. P.K. Mehta and P.J.M. Monteiro, "Concrete- Microstructure, Properties and Materials", McGraw-Hill, New York, 2014.
7. N. Jackson and R.K, Dhir, "Civil Engineering Materials", Basingstoke, Macmillan, London, 1988.
8. Defects and Deterioration in Buildings, EF & N Spon, London.
9. Non-Destructive Evaluation of Concrete Structures by Bungey – Surrey University Press.
10. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W.H. Ranso, (1981).
11. Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
12. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.

18CE E08

CONCRETE TECHNOLOGY
(Core Elective –2)

Instruction 3L Hours per week Duration of Semester End
Examination 3 Hours Semester End Examination
70 Marks CIE
30 Marks Credits
3

Course objectives: To enable the students to
1. Learn the properties & conduct tests on various ingredients of concrete.
2. Understand the behavior of concrete in fresh and hardened states.
3. Understand the Mix design of concrete using various design methods.
4. To learn the durability of concrete & acquire knowledge on the properties and effective usage of various admixtures.
5. Gain knowledge of various special concretes and their applications.

Course outcomes: At the end of the course, the student will be able to
1. understand the properties of concrete making materials and production of concrete.
2. analyze the properties of fresh and hardened concretes.
3. design the concrete mix using various methods for a specified grade.
4. evaluate durability of concrete and apply suitable admixtures in concrete making.
5. evaluate and choose appropriate concrete for field application.

UNIT- I:
Concrete Materials & Production of Concrete: Manufacturing process of cement, Types of cements, Properties of cement and aggregate (fine & coarse), tests conducted on cement and aggregate (fine & coarse). Production of concrete – Various methods of batching, mixing, compaction and curing. Hot weather and cold weather concreting. Water cement ratio, gel space ratio, Segregation and bleeding of concrete.

UNIT- II:
Fresh concrete: Workability, factors affecting workability, measurement of workability using slump cone, compaction factor and Vee-Bee Consistometer tests.
Hardened concrete: Behavior of concrete under various types of loading - compression, Tension and flexure. Non - destructive testing methods. Time dependent behavior of concrete –Maturity, shrinkage & creep.Stress-Strain behavior of concrete.

UNIT- III:
Concrete Mix Design: Basic considerations, Factor to be considered in choice of mix design, Different mix design methods – I.S. code method, British and ACI methods. Quality control of Concrete.

UNIT- IV:
Durability of concrete: Durability –Factors affecting Durability, Cracking of Concrete - types of cracks, causes, remedies and tests on concrete cracks. Deterioration of concrete and its prevention.Behavior of concrete under various types of extreme environments, Freezing and Thawing, Acid attack on concrete, Efflorescence, fire resistance.
Concrete Admixtures: Classification of admixtures, Mineral and Chemical admixtures, Influence of various admixtures on properties of concrete.

UNIT- V:

Special Concretes: Properties & applications of High Strength Concrete, High Performance Concrete, Polymer Concrete, High Density Concrete, Light Weight Concrete, and Ferro cement, Recycled Aggregate Concrete, Self Compacting Concrete (SCC) and Fly Ash Concrete. Ready Mix Concrete (RMC).

Fiber Reinforced Concrete(FRC): Mechanism, Types of fibers, Steel Fiber Reinforced Concrete – Properties & Applications, Geopolymer concrete – Constituent materials, properties and applications, Bacterial Concrete – principles of self healing, materials and applications

Text Books:

1. A.M Neville., “Properties of Concrete”, Pearson Education. 2012.
2. M.S. Shetty, and A. K. Jain, “Concrete Technology: Theory and Practice”, S. Chand & Company, 2018.
3. R. Santhakumar, “Concrete Technology”, Oxford University, Press 2018.

Suggested Reading:

1. A.M. Neville and J.J. Brooks, “Concrete Technology”, Dorling and Kindersley Publications, 2002.
2. P. K. Mehta, and J. M. M. Paulo, “Concrete- Microstructure – properties and Material”, Mc. Graw Hill Publishers, 2017.
3. N. Krishnaraju, “Design of Concrete Mixes”, CBS Publishers and Distributors, 2010.

18CE C16

TRANSPORTATION ENGINEERING LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: To enable the student

1. Assess the quality of the material used in pavement construction and compare with IRC specifications.
2. Identify the field data required for assessing the traffic parameters.

Course Outcomes: The student will be able to

3. Conduct various tests on bitumen and aggregates, evaluate the quality of material to be used in pavements.
4. Organize various traffic studies and analyze the data by applying statistical tools.
5. Conduct the CBR test, Marshall Stability tests and interpret the results for design purpose.
6. Prepare representative samples for various tests on aggregates.
7. Develop skill of generating technical report based on the studies carried in the laboratory and field studies.

A) Tests on bitumen

1. Penetration test
2. Ductility test
3. Softening point test
4. Specific gravity test
5. Viscosity test
6. Flash and fire point test

B) Tests on road aggregates

7. Aggregate crushing value test
8. Los Angeles abrasion test
9. Aggregate impact value test
10. Aggregate shape test (flakiness & elongation)
11. Water Absorption
12. Soundness

C) Traffic Studies

13. Traffic volume study
14. Spot Speed study
15. O & D study concepts
16. Speed and delay studies

D) Miscellaneous Tests (demonstration only)

17. Determination of CBR.
18. Preparation of representative sample by coning and quartering.
19. Bitumen extraction test
20. Marshall stability concepts and tests.

Suggested Reading:

1. Khanna and Justo, "*Highway materials and Pavement Testing*", Nem Chand & Bros. 2013.
2. R. Srinivasa Kumar, "*Highway Engineering*", Universities Press, 2011
3. IRC codes and specifications

18CE C17

GEOTECHNICAL ENGINEERING LAB

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: Students will able to
1. Identify physical and mechanical properties of soil in the field and laboratory.
2. Develop an understand the relationships between physical characteristics and mechanical properties of soils;
3. Understand techniques used in soil mechanics for Darcy's Law
4. Understand Mohr-Coulomb theory for shear strength behavior of soils.
5. Choose different tests for soils according to IS standards.

Course Outcomes: Upon successful completion of this course, students will be able to
1. Identify soils with reference to their characteristics.
2. Evaluate and classify soils according to IS classification.
3. Calculate seepage volume for different soils.
4. Examine methods to improve soil stability of soils.
5. Conduct tests according to IS laboratory standards and procedures.

List of Experiments:
1. Grain size distribution by Sieve Analysis.
2. Consistency limits - Liquid limit and Plastic limit using Casagrande's method.
3. Compaction test: Standard Proctor test.
4. Field Density using Sand Replacement method.
5. Field Density using Core Cutter method.
6. Specific gravity of soils.
7. Natural Moisture Content using Pycnometer method.
8. Direct Shear test.
9. Permeability test using Falling-head method.
10. Relative density

Demo Experiments:
1. Consolidation test
2. Triaxial test (UU)
3. Vane Shear test

Suggested Reading:

1. B. C. Punmia, "Soil Mechanics and Foundation Engg", (2005), 16th Edition Laxmi Publications Co. , New Delhi.
2. IS : 2720(part-3 1964) for specific gravity, (IS : 2720 (Part 17), 1966) for Sieve analysis IS : 2720 (Part-IV), 1965) for Grain size analysis, IS: 2720 (Part 1) - 1983 for shear strength tests and compaction.
3. T. W. Lambe," Soil Testing for Engineers"-., Wiley Eastern Ltd., New Delhi.
4. K. H. Head K.H."Manual of Soil Laboratory Testing"-., (1986)- Vol. I, II, III, Princeton Press, London.
5. J. E. Bowles J.E", Properties of Soil and Their Measurements",. (1988), - McGraw Hill Book Co. New York.
6. http://smfe-iiith.vlabs.ac.in/List%20of %20experiments.html?domain=Civil%20Engineering
7. http://home.iitk.ac.in/~madhav/geolab.html

PROFESSOR & HEAD
Department of Civil Engineering

18CE C18

AUTO CAD LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Outcomes: The student will be able to

1. Select and apply appropriate settings for coordinates, units and scale to the drawing.
2. Create 2D objects and use display commands.
3. Select and apply appropriate editing tools in the drawing and manage object properties.
4. Create text, blocks and insert them in the drawing.
5. Apply appropriate hatching and dimensioning to the drawing.

LIST OF EXPERIMENTS

1. Introduction to Computer Aided Drafting (AutoCAD) - features and environment.
2. Coordinates and Basic Drafting Tools: Exercises pertaining to basic building elements to illustrate use of absolute coordinates and relative Cartesian coordinates. Object tools, such as SNAP, GRID and initial settings of a drawing file.
3. Display commands: Drawing Scale & View magnification, zooming and panning Commands.
4. Creating 2D geometry: Creating LINE objects, creating CIRCLE, ARC, ELLIPSE, various POLYGONS and using POLYLINE.
5. Editing and construction techniques: Tools to assist drafting – Creating Offsets, Trimming and extending of lines, Filtering of corners, creating multiple objects through Mirroring and Array Generation.
6. Managing Object Properties: Concept and significance of Layers and its applications in building drawing - Use of different types of lines and line weights.
7. Creating Text and Defining Styles: Exercises in adding text to the drawing and management of text styles.
8. Introduction to Blocks: Significance of blocks in drawing – creating blocks of common building elements and their insertion.
9. Dimensions, Hatching and Plotting: Addition of dimensions to the drawing - Dimension style management - Hatching of sections - styles of hatch, Plotting.
10. Drawing 2-D Single story building plan with section and elevation.

Suggested Reading:

1. Shah M. G., Kale C. M and Patki S. Y, "*Building Drawing*", Tata McGraw-Hill Book Co., 2002.
2.George Omura , Brian C. Benton," *Mastering AutoCAD 2019 and AutoCAD LT 2019*", Wiley, 2018.
3. Balagopal A and Prabhu T. S., "*Building Drawing and Detailing"*, Spades publishers, Calicut, 1987.

18CE C19

DESIGN OF STEEL STRUCTURES - I

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Codes required: IS 800 – 2007, IS 875 Part II & Part III and Steel Tables.

Course Objectives: To enable the students

1. Learn and apply the design philosophies(working stress method andlimit state method) for various steel structural components and their connections, as per the relevant standard
2. To understand the behavior of compression members.
3. To understand the modes of failure of tension members.
4. To understand the behavior of flexural members in the industry
5. Learn the behavior of trusses and design of purlins.

Course Outcomes: At the end of the course, the student will be able to

1. understand the material properties, loads and design philosophies, design bolted and welded connections.
2. know, how yielding & buckling takes place, design simple and built-up compression members and column bases
3. understand the modes of failure of tension members ,design tension members using limit state method ,design tension and compression members using working stress method as per IS: 800-2007
4. classify structural steel sections, distinguish between laterally supported and laterally unsupported beams, design simple flexural members including secondary considerations
5. estimate the loads on roof trusses and design purlins and members of trusses

UNIT – I:
Materials and Specifications: Chemical composition of steel, types of Structural Steel, classification of Rolled Steel Sections.
Design Philosophies: Working Stress Method, Limit State Method, Loads and Load Combinations,Partial safety factors for materials and loads.
Bolted Connections (Limit State Method):
Bolted Joints -Modes of failure - Design of Bolted joints using ordinary Black Bolts - Lap & Butt joints - Concentric Connections and Eccentric Connections, Introduction to High Strength Friction Grip Bolted connections.
Welded Connections (Limit State Method): Types of Welds, Lap and Butt Joints- strength of welded joints -design of welded joints - Concentric Connections and Eccentric Connections.

UNIT – II
Design of Compression Members (Limit State Method): Introduction, yielding & Buckling phenomena, Sections used for compression Members. Effective Length of Compression Members, Design of Compression Members with single section and Built-up Sections, Lacing and Battening, Column Splices.

Design of Column Bases: Design of Slab and Gusset Bases.

UNIT – III
Design of tension members (Limit State Method): Introduction to tension members - Applications of tension members, Modes of Failure, Design of Tension Members –Staggered bolting ,Design of Lug Angles.
Working Stress Method as per IS 800-2007: Permissible Stresses, Slenderness Ratio, Design of tension members, Design of Simple Compression Members.

UNIT – IV

Design of Beams (Limit State Method) : Introduction to Plastic Analysis –Plastic Hinge, Plastic moment, Shape factor; Classification of Cross Sections, Phenomenon of Lateral Torsional Buckling; Design of Laterally Supported beams and laterally Unsupported Beams, Secondary considerations - Check for Web crippling, web buckling & deflection.

UNIT – V

Design of Roof trusses (Limit State Method): Types of trusses, Estimation of loads- dead load, live load and wind load, Design of purlins, Analysis of roof trusses and design of its members with angle sections.

Text Books:

1. S. K. Duggal, "Limit State Design of Steel Structures", 3^{rd} Edition, McGraw Hill HED, 2019.
2. N. Subramanian, "Design of Steel Structures, Limit States Method", 2^{nd}Edition, Oxford University Press, 2016

Suggested Reading:

1. M.R. Shiyekar, "Design of Steel Structures, (Limit State Method", Second Edition, PHI Learning Pvt Ltd. 2013.
2. S. S. Bhavikatti, "Design of steel Structures", 3rd Edition, I.K.International Publishing House Pvt. Ltd. 2012.

18CE C20

ENVIRONMENTAL ENGINEERING

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student
1. Understand methods of population forecasting, estimate water quantity to be supplied in towns and design water distribution network.
2. Understand and design various units of a water treatment plant.
3. Calculate sewage produced in residential areas and design conveyance components.
4. Learn about design components of waste water treatment plants, low cost treatment techniques and sludge digestion systems.
5. Address issues of air pollution and noise pollution with the aid of appropriate control methods.

Course Outcomes: At the end of the course, the student will be able to
1. identify an appropriate population forecasting method and estimate quantity of water to be supplied and plan & design conveyance components.
2. design water treatment units for a water treatment plant.
3. estimate quantity of sewage and storm water & characteristics of sewage, design sewers and plan sewer appurtenances.
4. design components of waste water treatment plant and sludge digestion systems.
5. understand and judge methods for control of particulate matter and gaseous pollutants in the atmosphere, outline noise pollution control methods.

UNIT – I:
Introduction: Protected water supply, population forecasting methods, design period, types of water demand, factors affecting, fluctuations, fire demand, drinking water standards; sources of water, comparison from quality and quantity and other considerations; intakes, infiltration galleries; Design of distribution systems, pipe appurtenances.

UNIT – II:
Water treatment: Sedimentation principles, design factors, coagulation, flocculation, clarifier design, coagulants, feeding arrangements. Filtration theory, working of slow and rapid gravity filters, multimedia filters, design of filters, troubles in operation, comparison of filters, disinfection, theory of chlorination, chlorine demand, other disinfection practices.

UNIT - III:
Characteristics of sewage: Waste water collection, estimation of waste water and storm water, decomposition of sewage, self purification of rivers, examination of sewage, B.O.D. Equation, C.O.D. Design of sewers, shapes and materials, sewer appurtenances, house drainage, plumbing requirements, sanitary fittings, traps, one pipe and two pipe systems of plumbing.

UNIT – IV:
Waste water treatment: Primary treatment: screens, grit chambers, skimming tanks, sedimentation tanks, principles of design, Biological treatment: Design of trickling filters, Activated Sludge Treatment and oxidation ponds. Sludge digestion: factors affecting, design of digestion tank, septic tanks: working principles and design, soak pits, ultimate disposal of sewage.

UNIT – V:
Air pollution: Meteorological parameters affecting air pollution, atmospheric stability, plume behaviour, control of particulates, gravity settlers, cyclone filters, Electrostatic precipitators; Control of gaseous pollutants.
Noise – Basic concept, measurement and various control methods.

PROFESSOR & HEAD

Text Books:
1. B.C Punmia, Ashok.K.Jain, Arun K .Jain "*Environmental Engineering I",* Laxmi Publications; 2016.
2. B.C Punmia, Ashok.K.Jain, Arun K .Jain "*Environmental Engineering II*", Laxmi Publications; 2016.
3. Santosh Kumar Garg, "*Water Supply Engineering*", Khanna Publications, 2017.
4. Santosh Kumar Garg, "*Sewage Disposal and Air Pollution Engineering*", Khanna Publications, 2018.

Suggested Reading:
1. H.S Peavy, D. R. Rowe," *Environmental Engineering*", McGraw Hill Education (India) Pvt. Ltd, 2017.
2. Metcalf and Eddy, "*Waste Water engineering*", McGraw Hill, 2015.
3. Mark J Hammar and Mark J. HammarJr," *Water and Waste Water Technology*".Wiley, 2007.
4. "*Manual on Water Supply and Treatment*", Ministry of Urban Development, New Delhi.
5. "*Manual on Sewerage and Sewage Treatment Systems, Part A, B and C*", Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.

18CE C21

ENGINEERING GEOLOGY

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:-The Students Will able to
1. Describe the various properties of minerals, distinguishing features of rocks.
2. Describe the geological structures, processes of weathering and classification of soils.
3. Explain the process of ground water exploration
4. Illustrate the knowledge of geological studies for dams and reservoirs.
5. Illustrate the knowledge of geological studies for tunnels; list the causes and effects of earth quakes, tsunamis and landslides with their mitigation measures.

Course Outcomes: Upon the completion of course, students will be able to
1. identify different minerals and distinguish features exhibited by the rocks.
2. identify the geological structures like folds, faults, joints and unconformities present in rock and describe the processes of weathering.
3. assess the occurrence of ground water in various litho logical formations and location of bore wells.
4. evaluate the suitability of site for the dam construction.
5. evaluate the suitability of site for the tunnel construction; recognize the causes and effects of earthquakes, tsunamis and landslides in geological aspects.

UNIT- I:
Introduction: Branches of Geology useful to civil engineering scope of geological studies in various civil engineering projects.
Mineralogy: Definition of Mineral and crystal. Physical properties used in the identification of minerals. Physical properties of quartz, Orthoclase, Hornblende, Biotitic, Muscovite, Talc, Barite, Calcite, Kyanite and corundum.
Rocks:- Geological classification of Rocks, Textures and structures Geological description and Indian occurrence of granite, Basalt, Dolerite, Gabbro, Laterite, Sand stone, Shale, Limestone slate, Gneiss, Schist, Quartzite, Marble, and Khondalite.

UNIT- II:
Geological Structures: Classification mode of origin and engineering consideration of Folds, Faults, Joints and unconformities.
Rock Weathering: Definition of Rock weathering, classification of weathering Engineering consideration of Rock Weathering.
Geology of Soils: Formation of soil, Soil Profile important clay minerals, Geological classification of soils, Types of Indian Soils.

UNIT- III:
Hydro Geology: Hydrological cycle, Zones of Ground water Aquifers, Aquifuge, Aquiclude and Aquitards. Springs, ground water exploration, ground water provinces of India.

UNIT- IV:
DAMS: Terminology of Dam, types of dams, Geological investigation for selection of a good dam site. Analysis of Dam failures in the past .Engineering geology of major dam sites and Reservoirs of India.

UNIT-V:
Tunnels: Geological investigations of tunnels problems of tunneling, over break, logging of tunnels geology of some well known tunnels.
Geological Hazards: Geological aspects of earthquakes, tsunamis and landslides.

Text Books:
1. Parbinsingh, "*Engineering and general Geology*", S.K.Kataria& sons, New Delhi 2010.
2. Chennakesavulu, "*Text book of Engineering Geology*", Macmillan India Ltd, 2009.
3. D. Venkata Reddy, "*Engineering Geology*", Vikas Publishers House Pvt. Ltd 2010.

Suggested Reading:
1. F. G. Bell, "*Fundamentals of Engineering Geology*", Aditya Books Pvt. Ltd., New Delhi 2007
2. D. P. Krynine and W. R. Judd, "*Principles of Engineering Geology and Geotechnics",* CBS publishers Distribution First India Edition 1998.
3. SubinoyGangopadhyay, "*Engineering Geology*", Oxford University press 2013.
4. "*Seismo Tectonic Map of India*", Geological Survey of India 2005.

18CE E09

STRUCTURAL ANALYSIS -III
(Core Elective-3)

Instruction	3L Hours per week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
CIE:	30 Marks
Credits:	3

Course Objectives: To enable the student to

1. Understand the concept of analyzing two hinged arches and the redundant trusses.
2. Use the approximate methods to analyze the multi-storey frames for gravity and lateral loads.
3. Apply the Flexibility method and to analyze the indeterminate beams, plane frames and trusses.
4. Comprehend the Stiffness method and analyze the indeterminate beams, plane frames and trusses.
5. Get exposed to basic concepts of finite element method and solve simple numerical problems.

Course Outcomes: At the end of the course, the student will be able to

1. determine the support reactions and bending moment, normal thrust and radial shear at a section for point loads and udl, apply Castigliano's theorem –II and Unit load method to determine the forces in the members of the redundant pin-jointed plane frames.
2. analyze the multi-story frames for gravity and lateral loads by using approximate methods
3. analyze the indeterminate beams, rigid jointed plane frames and trusses using flexibility matrix method for different load conditions.
4. apply Stiffness matrix method to analyze the indeterminate beams, rigid jointed plane frames and trusses, for different load conditions.
5. formulate stiffness matrix for bar, truss and beam element and apply to analyze axially loaded members, trusses and beams.

UNIT – I:

Two hinged arches: Parabolic and segmental arches, determination of horizontal thrust, bending moment, normal thrust and radial shear for static loading, temperature effects.

Redundant pin-jointed plane frames (trusses): Analysis of pin-jointed plane frames using Castiglione's theorem – II and Unit load method, with one degree of redundancy (internal / external), Assembly and temperature effects.

UNIT-II:

Approximate Methods of Analysis: Introduction – Analysis of multi-storey frames by Portal and Cantilever methods for lateral loads and Substitute Frame method for gravity loads.

UNIT– III:

Flexibility method of Analysis: Introduction, Analysis of continuous beams, and rigid jointed plane frames with static indeterminacy not exceeding three. Analysis pin jointed plane frames with static indeterminacy not exceeding two.

UNIT-IV:

Stiffness method of Analysis: Introduction, Analysis of continuous beams, and rigid jointed plane frames with kinematic indeterminacy not exceeding three. Analysis pin jointed plane frames with kinematic indeterminacy not exceeding two.

UNIT-V:

Basics of Finite Element Method: Introduction, Discretization of a structure, Types of Elements. Formulation of stiffness matrix for bar element, Truss element and Beam element. Numerical Problems with degree of freedom not exceeding three.

Text Books:

1. T. S. ThandavaMoorthy, "*Structural Analysis*", Oxford University Press, 2nd Edition, 2012.
2. C. S. Reddy, "*Basic Structural Analysis*", Tata McGraw Hill, 3rd Edition 2017.

Suggested Reading:

1. B.C. Punmia, and A. K. Jain, "*SMTS - II Theory of Structures*", Laxmi Publications, 2017.
2. S. Ramamrutham, "*Theory of Structures*", Khanna Publishers, 2018.
3. D. S. PrakashRao, "*Structural Analysis" - A Unified Approach"*, University Press, 2012.
4. W. Weaver, JR. and J. M. Gere., "*Matrix Analysis of Framed Structures*", CBS Publishers, 2nd edition, 2004

PROFESSOR & HEAD
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Chaitanya Bharathi Institute of Technology
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18CE E10

FOUNDATION ENGINEERING
(Core Elective-3)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the students
1. Understand the stress distribution in the soils for different loading conditions
2. Understand the principle of bearing capacity and settlement analysis.
3. Understand the principles of single and group piles.
4. Select suitable methods for construction of coffer dams and caissons.
5. Understand the principles of site investigation techniques and timbering of excavations.

Course outcomes: At the end of the course the students will be able to
1. compute the stress distribution in the soil under different loading conditions.
2. estimate the bearing capacity and compute settlements for different soils in shallow foundation.
3. estimate the load carrying capacity of single and group of piles.
4. understand the construction techniques and performance of cofferdams and caissons.
5. identify suitable investigation techniques for soil exploration and compute the loads in timbering of excavations.

UNIT- I:
Stress distribution in Soils: Boussinesq's and Westergaards equations for point load. Application of point load formulae for uniformly distributed load on circular area, Line load, Strip Load, rectangular area. Use of Newmark's chart for different areas using Boussinesq's equation, Contact pressure distribution.

UNIT- II:
Bearing capacity of soils: Terzaghi's equation for bearing capacity in soils –for continuous, square, rectangular and circular footings, general and local shear failure conditions. Plate load test as per IS specification. Allowable bearing capacity.Standard penetration test and use of N values for estimating soil conditions and bearing capacity.

Settlement Analysis: Computation of pressures before loading and after loading. Estimation of settlement – ultimate settlementand after any given period.

UNIT- III:
Pile Foundations: Types of piles–Timber, steel, concrete, cast-in situ, precast piles, bearing piles, friction piles, compaction piles, large diameter piles. Pile capacity – Static formulae, dynamic formulae, pile load test, determination of point resistance and skin friction as per IS code. Bearing capacity of pile groups, negative skin friction.

UNIT- IV:
Coffer dams: General description and construction methodsEarth embankments, cantilever sheet piles, braced coffer dams. Double wall cofferdams, cellular coffer dams – circular, diaphragm type.

Caissons: types of caissons–Open caissons, pneumatic caissons, box caissons (floating caissons). General description and construction methods.Dewatering techniques: sumps, ditches. Well points, deep walls. Geotextile methods: Types and uses.

UNIT- V:
Site investigation: Principles of exploration, sampling methods, transportation and storage of samples, boring and drilling methods, log of bore holes, sampling tubes and samplers. Sampling records.
Timbering of excavation: Bracing for shallow and deep excavations. Computation of lateral earth pressure.Reaction of struts.

PROFESSOR & HEAD

Text Books:

1. K. R. Arora, “Soil Mechanics and Foundation Engineering”, 7th Edition, Standard Publishers, 2009.
2. GopalRanjan, “Basic and Applied Soil Mechanics”, 3rd Edition, New Age International, 2016.

Suggested Reading:

1. B.C. Punmia and Ashok Kumar Jain and Arun Kumar Jain, “Soil Mechanics and Foundations”, Laxmi Publications, 16th Edition, 2017.
2. E. J. Bowles, “Foundation Analysis and Design”, Tata McGraw Hill, 2017.
3. IS: 2911 – (part-IV) – Codes of practice for design and Construction of Pile Foundations – Load test on piles.
4. IS 1888 - 1982: Method of load test on soils.

18CE E11

WATERSHED MANAGEMENT
(Core Elective-3)

Instruction	3LHoursperweek
DurationofSemesterEndExamination	3Hours
SemesterEndExamination	70Marks
CIE	30Marks
Credits	3

Course Objectives: To enable the student

1. Understandtheconceptsofwatershedmanagement,socioeconomic aspects related to watersheddevelopment.
2. Understandcharacteristicsofwatershed,soilerosionanditscontrol.
3. Familiarize with various water harvesting techniques and land use managementpractices.
4. Understand social aspects of watershedmanagement
5. Understand the concept of integrated watershed management and ecosystemmanagement.

Course outcomes: At the end of the course, the student will be able to

1. identify relevance and scope of watershed management.
2. identify causes of soil erosion and understand its control measures.
3. understand waterharvesting structures and land management practices.
4. understand the participation of stake holders in watershed management.
5. understand soil and agricultural ecosystem and identify integrated approach of watershed management.

UNIT – I:
Definition and concept of Watershed: Concept of watershed development, History of Watershed management and its relevance to India, objectives of watersheddevelopment,differentstakeholdersandtheirrelativeimportance,need for watershed development in India, selection of watershed, watershed policy issues, Integrated and multidisciplinary approach for watershedmanagement.

UNIT – II:
Characteristics of Watershed: Size, shape, physiographic, slope, climate, drainage,landuse,vegetation,geologyandsoils,hydrologyandhydrogeology, socioeconomiccharacteristics.
Principles of Erosion: Types of erosion, factors affecting erosion, effects of erosiononlandfertilityandlandcapability,estimationofsoillossduetoerosion. **Measures to Control Erosion**: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, rock fill dams, brushwood dam, Gabion.

UNIT – III:
Water Harvesting: Rainwater harvesting, catchment harvesting, harvesting structures& Design of harvesting structures,soilmoistureconservation,checkdams,artificialrecharge,farmponds and percolation tanks. Roof top waterharvesting.
LandManagement:Landuseandlandcapabilityclassification,managementof forest,agricultural,grassland andwildland,reclamationofsalineandalkaline soils.

UNIT – IV:
SocialAspectsofWatershedManagement:PlanningofWatershedmanagement activities, community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Casestudies.

UNIT – V:
Integrated Watershed Management: Introduction to integrated approach, Integrated water resources management, conjunctive use of water resources.

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EcosystemManagement:RoleofEcosystem,crophusbandry,soilenrichment, inter mixed and strip cropping, cropping pattern, sustainable agriculture, bio- mass management, dry land agriculture, horticulture, social forestry and a forestation.

Text Books:

1. Murthy,J.V.S.,"*WatershedManagement*",NewAgeInternational(P), Ltd., NewDelhi,1988.
2. Majumdar,D.K.,"*IrrigationandWaterManagement*",PrenticeHall, NewDelhi, 2000.

Suggested Reading:

1. Mohan Das, M. and Das Saikia, "*Watershed Management*." PHI Learning(P).,Ltd.,NewDelhi,2013.
2. Goswami, M.D.,"*Watershed Management: Theroy and Practices*." RitwikandGargee(P).,Guwahati,Assam,2004.
3. Haan, C.T., Johnson, C.T., AND Brakensiek, D.L,.*"Hydrologic ModelingofSmallWatersheds*."ASAE,Michigan,1982.
4. SrinivasaRajuK.andNageshKumarD,"*MulticriterionAnalysisin EngineeringandManagement*",PrenticeHallofIndia(PHI)Learning Pvt.Ltd,NewDelhi,2014.

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18CE E12

URBAN TRANSPORTATION PLANNING
(Core Elective-3)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:
1. To understand the importance and the steps involved of transportation planning.
2. To identify the data required for creating and improving transportation infrastructure
3. To get knowledge about the traffic data acquisition process and analysing for understanding traffic growth pattern.
4. To understand the concepts of modelling techniques applied in transportation planning.
5. To know the ways to apply economic evaluation criteria to transportation project.

Course outcomes: At the end of the course, the student will be able to
1. apply the fundamental knowledge for forecasting and creating the transportation infrastructure facilities scientifically and ethically by collecting the appropriate sample data.
2. identify the procedures for collecting the traffic related data for generating and validating transport demand models.
3. apply four stage transportation demand modelling by creating mathematical models to understand the travel pattern and behavior of road users.
4. apply the mathematical knowledge in solving the transportation planning related problems by analyzing transportation data.
5. evaluate highway projects by using different economic methods and understand the role of computer applications in transportation planning.

UNIT - I:
Introduction of concepts of Transportation planning process, Interdependence of the land use and traffic, systems approach to transportation planning, stages in transportation planning, survey and analysis of existing conditions, forecast analysis of future conditions and plan synthesis, evaluation, program adoption and implementation.

UNIT - II:
Transportation Surveys – Introduction, definition of the study area, zoning, types of surveys, home interview, commercial vehicle, taxis, roadside interview, postcard questionnaire, registration number of vehicle plate, tags on vehicles, mass transport, analyzing the data from samples.

UNIT - III:
Trip Generation – Introduction and definition, trip purpose, factors governing trip production and attraction rates, regression methods – multiple linear regression analysis. Trip Distribution – concepts of trip distribution, methods of trip distribution, uniform (constant) factor method, average factor method, Fratar method, Furness method, advantages and disadvantages of growth factor methods, the gravity model.

UNIT - IV:
Modal split – General considerations, factors affecting modal split, modal split in the transportation planning process. Traffic Assignment – purpose of traffic assignment, general principles, assignment techniques, all or nothing assignment, multiple route assignment, capacity restraint assignment, diversion curves.

UNIT - V:

Economic evaluation of highway projects – need, basics principles, methods - benefit cost ratio, net present value, First year rate of return and internal rate of return - comparison. Computer applications in Transportation planning.

Text books:

1. B. G. Hutchinson, "*Principles of Urban Transport Systems Planning*", McGraw –Hill, Newyork, 1974.
2. C. S. PapacostasandP. D. Prevedouros, "*Transportation Engineering and Planning*", Pearson education India, 2015.

Suggested Reading:

1. L.R. Kadiyali "*Traffic Engineering and Transportation Planning*" Khanna Publishers, 2011.
2. Sarkar, Pradip Kumar, Maitri, Vinay, Joshi, G.J. "*Transport Planning: Principles, Practice and Policies*" PHI Learning, 2017.

18CE E13

FINITE ELEMENT METHODS
(Core Elective-4)

Instruction:	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination:	70 Marks
CIE:	30 Marks
Credits:	3

Course Objectives: To enable the student

1. Learn the fundamentals of Finite element method (FEM) and derive elasticity matrices for 2-D, 3-D and axisymmetric elasticity problems.
2. Understand basic principles of minimum potential energy methods, Principle of virtual work and various coordinate systems
3. Understand the FEM formulation for bar, truss elements and analyze simple problems with kinematic indeterminacy not greater than three.
4. Understand the FEM formulation for beam element and rigid jointed plane frame element and analyze simple problems with kinematic indeterminacy not exceeding than three.
5. Get familiarized with displacement models, Iso-parametric elements, 2D CST elements and rectangular elements and know the formulation of global stiffness matrices and load matrices and Gauss Quadrature rule

Course Outcomes: At the end of the course, student will be able to

1. apply the fundamentals of FEM, elements of theory of elasticity for 2D, 3D and axisymmetric problems.
2. apply Principle of minimum potential energy and Principle of Virtual work; analyze simple problems using Rayleigh Ritz Method and Galerkin's method.
3. formulate the local and global stiffness matrix, load matrix for 1D bar elements and 2D truss elements and analyse simple problems.
4. develop the stiffness matrix for beams and rigid jointed plane frames and solve problems with degree of freedom not exceeding three.
5. select displacement functions, formulate the stiffness matrix, load matrix for CST elements. Use Iso-parametric elements and quadrilateral elements, and evaluate definite integral by Gauss Quadrature.

UNIT- I:

Introduction to FEM: General description of the method, brief history of the method, applications of the method, advantages of the finite element method, steps in the finite element method. Types of elements, Types of forces, and Boundary conditions. Strain displacement, and stress- strain relations for 2-D, 3-D problems & Axisymmetric elements. Equations of equilibrium and compatibility conditions for 2-D and 3-D problems. Plane stress and plane strain situations and derivation of elasticity matrices.

UNIT- II:

Finite Element Formulation: Principle of minimum potential energy, Principle of virtual displacement, Raleigh Ritz method, Weighted Residual method- Galerkin's method. Coordinate system - Global coordinate, local coordinate and natural coordinate system.

UNIT- III:

Bar Elements: Shape functions, stiffness matrix for a 2- noded bar element, axial bar subjected to point loads, surface forces and body forces - constant cross section and varying cross section bar.

Truss Elements: Transformation matrix, Stiffness matrix of truss member in local and global coordinate, analysis of trusses with kinematic indeterminacy not exceeding three.

UNIT- IV:

Beam Elements: Shape functions, beam element stiffness matrix, element load vector, and analysis of continuous beams with kinematic indeterminacy not exceeding three.
Plane Frame elements: Element stiffness matrix in local coordinates,
Transformation or Rotation matrix, and stiffness matrix and load vector in global coordinates.

UNIT-V:
Displacement models: Selection of displacement models, geometric invariance, conforming and non-conforming elements.
2-D Triangular Elements (CST) and Rectangular Elements: Determination of strain-displacement matrix, shape functions, determination of element stiffness and load matrices, assembling global stiffness and load matrices.
Iso-parametric elements: Iso-parametric concept, Iso-parametric, Sub parametric and Super parametric elements. Gauss Quadrature of numerical integration.

Text Books:

1. David V. Hutton, "*Fundamentals of Finite Element Analysis*", McGraw Hill Education (India) Private Limited, Delhi, 2014.
2. P. N. Godbole," *Introduction to Finite Element Method*", I. K. International Publishing House Pvt. Ltd. New Delhi, 2013.
3. P. Seshu, "*Finite Element Analysis*", Prentice Hall of India Private Limited, New Delhi, 2010.

Suggested Reading:

1. T. R. Chandrupatla and A. D Belegundu, "*Introduction to Finite Elements in Engineering*", Prentice –Hall of India Private Limited, New Delhi, 2009
2. Daryl L, Logan, "*A first course in the Finite Element Method*", Third Edition, Thomson Brook, Canada Limited, 2007.
3. R. D. Cook, "*Concepts and Applications of Finite Element Analysis*", John Wiley and sons, 1981.
4. O. C. Zienkiewicz and R. Taylor, "*The Finite Element Method*", Vol.1, McGraw Hill Company Limited, London, 1989.

18CE E14

REINFORCED CONCRETE DESIGN-II
(Core Elective-4)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The student shall be able to
1. Comprehend the concepts of design and detailing of combined rectangular and trapezoidal footings.
2. Understand the design and detailing of cantilever and counterfort type of retaining walls.
3. Learn the concepts of design and detailing of various water tanks.
4. Grasp the knowledge from relevant IRC codes, design and detailing of RC solid slab bridge.
5. Know the procedures for design and detailing of T-beam bridges.

Course Outcomes: At the end of the course the student will be able to
1. develop the plan layout, design and detail rectangular & trapezoidal combined footings and beam-slab type raft footing.
2. analyse for stability, design, the various components and detail cantilever and counterfort type retaining walls.
3. interpret the specifications from relevant codes, determine the design forces, design various components and detail rectangular and circular water tanks including Intze tanks.
4. understand the clauses from relevant IRC codes, design and detail the various components of Solid slab bridge.
5. analyse the slab panels using effective width method/ Pigeaud's curves, girders using Courbon's method and design & detail the various components of T-Beam bridges.

UNIT – I:
Combined Footings: Limit state design & detailing of combined rectangular and trapezoidal footings – Design of raft footings (Beam Slab type up to 3 x 2 grid)
UNIT – II:
Retaining walls: Limit state design and detailing of cantilever and counterfort type of retaining walls under various conditions of backfill.
UNIT – III:
Water tanks: Elastic Design & Detailing of circular and rectangular ground level and over-head tanks, Design principles of Intze tank - Design of staging for wind loads.
UNIT – IV:
Bridges: Basic components- Types of bridges -Loads on bridges- IRC standards; Elastic design and detailing of two lanes, simply supported RC Solid Slab Bridge including Kerb.
UNIT- V:
T-beam bridges: Components of a T-beam bridge- Elastic design and detailing of two lane, Simply Supported, Three girder T-beam bridge- Use of effective width method- Pigeaud's curves and Courbon's method.

Text Books:
1. N. Krishna Raju, "*Advanced Reinforced Concrete Design (IS: 456-2000)* ", CBS Publications 2nd Edition,2010.
2. Vazirani and Ratwani," *Design Of Concrete Bridges*", Khanna Publishers, 1998.

Suggested Reading:
1. D. S. PrakashRao, "*Design Principles and Detailing of Concrete Structures*", Tata McGraw-Hill Publishing Co. Ltd., 1998.
2. D. Johnson Victor, "*Essentials of Bridge Engineering*", paperback, Oxford & IBH, Publishing Co., New Delhi, 6th Edition, 2015.

3. S. Ponnuswamy, “*Bridge Engineering*”, Tata McGraw Hill, Third Edition, 2017.4. N. Krishna Raju, “Design of Bridges”, Oxford &IBHPubs Company New Delhi, Fourth Edition, 2008.

18CE E15

RAILWAY ENGINEERING
(Core Elective-4)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. To understand about permanent way and its components and their functions
2. To know about the geometric standards of railway track.
3. To know the role and the construction of Points and constructions
4. To know the importance of maintenance of railway track
5. To know the role of signals and their components and the requirements of drainage system

Course Outcomes: At the end of the course, the students will be able to

1. understand the role played by various components of permanent way.
2. apply engineering knowledge to geometric design of a railway track as per the standards.
3. understand the importance and components of points and crossings.
4. create facilities for railway passengers and goods, identify procedures to be followed for maintenance of track.
5. understand various types of railway signals and their functions, need and requirements of drainage system in railway tracks.

UNIT- I:

Introduction to Railway Engineering: History of development of railway engineering, brief introduction of railway zones, classification of Indian railway, Permanent way- rail gauges- types, uni-gauge policy, ideal requirements, Rails, types of rails, rail fastenings, rail joints, creep - causes, measurement, remedial measures for rectification of creep, Adzing of rails, Sleepers- function of sleepers, requirements of sleepers, sleeper density, types of sleepers, Ballast- functions of ballasts, requirements of ballasts, screening of ballasts, size and quantity of rail ballasts.

UNIT– II:

Geometric Design of Track: Curvature of track, designation of curves, types of curves, design of transition curves, cant concept, cant deficiency, cant excess, speeds of trains on curves, types of gradients, and grade compensation.

UNIT– III:

Points and Crossings: Introduction of right and left hand turn outs, terms used in points and crossings, components, length of stock rail, tongue rail, heel clearance, Crossings- types of crossings- ordinary and double crossings, theoretical and actual nose of crossing, crossing angle, types of leads calculations, Design and maintenance of points and crossings.

UNIT– IV:

Track Maintenance, Stations and Yards: Necessity for maintenance of track, maintenance of track proper, maintenance of railway bridges, maintenance of rolling stock, signaling during maintenance, tools required during maintenance, rail inspection, track inspection, modern methods of track maintenance. Definition of station, selection of site for railway station, features of railway station, types of railway stations definition platform types, Dimensions of platform, definition of a yard, types of yard,

UNIT– V:

Signals and Track Drainage Systems: Objectives of signaling, types of signals, classification based on function, classification based on location, and special signals, typical layouts, control of movement of trains, Interlocking – principles of interlocking and methods of interlocking. Drainage system - significance of drainage system, requirements of drainage system.

Text Books:

1. S.P.Arora, Prof. S.C. Saxena," *Railway Engineering*", DhanpatRai Publications Pvt. Ltd., New Delhi, 2010.
2. S.C. Rangwala , "*Railway Engineering* " , Charotar Publishing House Pvt. Ltd. (2017)

Suggested Reading:

1. Satish Chandra, M. M. Agarwal," *Railway Engineering*", Oxford, second edition, 2013.
2. K. P. Subramanian, "*Highway, Railway, Airport and Harbour Engineering*", 2015. Scitech Publications (India) Pvt. Ltd.,

   R. Srinivasa Kumar, "*Airport, Railway, Docks &Harbors*", Universities Press, 2014.

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18CE E16

GROUND WATER ENGINEERING
(Core Elective –4)

Instruction	3LHoursperweek
DurationofSemesterEndExamination	3Hours
SemesterEndExamination	70Marks
CIE	30Marks
Credits	3

Course objectives: The student should able to understand,

1. Basicsofgroundwaterhydrology,familiarwithaquiferparameters.
2. Unsteady flow and its flowcomputation.
3. Exploring groundwater through surface and subsurface methods.
4. Artificial recharge and causes, methods ofrecharge.
5. Various models in groundwater, quality of groundwater, pollutant transport.

Course outcomes: At the end of the course, students will be able to

1. understand the concepts of groundwater flow and basic equations.
2. distinguish between steady and unsteady flow and solve the relevant problems.
3. explore and estimate groundwater potential.
4. understand the artificial recharge, sea water intrusion and control measures.
5. identify and define groundwater contamination and construct groundwater models.

UNIT- I:
Introduction: Occurrenceofgroundwater,problemsandperspectivesregarding groundwaterinIndia,rockpropertieseffectinggroundwater,groundwaterbasin, ground water in hydrologic cycle, vertical distribution of ground water, Hydrologicbalanceequation,typesofaquifers,unconfined,confinedandleaky aquifers. Darcy's law and limitations, compressibility of aquifer, aquifer parameters, specific yield, safe yield, general equation of ground water flow, steadyunidirectionalflow.Steadyradialflowtoawellinunconfinedandconfined aquifers.Steadyflowwithuniformrecharge.

UNIT-II:
Unsteadyradialflowtoawell: Nonequilibriumequationforpumpingtests.Theismethodofsolution,CooperJacobmethod,Chow'smethodsofsolution.Lawof times,wellflownearaquiferboundaries,Imagewelltheory,multiplewell systems, well losses, pumping and recuperationtests.

UNIT-III:
Geophysical Exploration:
Surface investigations: Surface investigations of ground water – electrical resistivity method, seismic refraction method, gravity and magnetic methods, geologic methods, dowsing, remote sensing.
SubsurfaceInvestigations: Testdrilling,resistivitylogging,temperaturelogging, caliper logging, Interpretation of logs and selecting the groundwater potential zones.

Unit- IV:
Artificial Recharge of groundwater: Methods of recharge, water spreading, sewage discharge, recharge through pits and shafts, recharge through well, induced recharge.
Seawaterintrusionincoastalaquifers,occurrence,Ghyben–Herzbergrelation, shape of fresh – salt water interface, Length of the intruded sea water wedge. Prevention and control of sea waterintrusion.

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Unit-V:
Modeling Techniques: Introduction, ground water models, sand models, viscous fluid models, membrane models, thermal models, electric - analog models.Numerical modeling, finite difference method.
Qualityofgroundwater: GroundwaterContamination,sourcesofgroundwater contamination, groundwater quality criteria, advection process, diffusionand dispersion process, pollutant transport equation and modeling of pollutant transport.

Text Books:

1. D.K. Todd, "*Ground Water Hydrology*", John Wiley & Sons, Inc., USA,2015
2. H.M.Raghunath,"*GroundWater*",WileyEasternLimited,NewDelhi, 2007.

Suggested Reading:

1. Bouwer,"*GroundWaterHydrology*",Mc.GrawHill,Newyork,2013
2. A. K. Rastogi, "*Numerical Groundwater Hydrology*", PenramInternational Publishing, Mumbai,2007.
3. J.Bear,"*HydraulicsofGroundWater*",Mc-GrawHill,Newyork,2013.

18CE E17

APPLICATION OF ARTIFICIAL INTELLIGENCE IN CIVIL ENGINEERING
(Core Elective 4)

Instruction	3LHoursperweek
DurationofSemesterEndExamination	3Hours
SemesterEndExamination	70Marks
CIE	30Marks
Credits	3

Course Objectives: The main objectives of this course are:

1. Provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. Learn various types of neural networks and study the applications of neural networks
3. Learn the concepts of Fuzzy systems and applications in civil engineering
4. Study the applications of support vector machines in civil engineering
5. Study the different types of regression analysis techniques and applications in civil engineering

Course Outcomes: On Successful completion of this course, student will be able to

1. recall fundamental knowledge on artificial intelligence.
2. understand neural networks and their types and apply neural networks in the domain of civil engineering.
3. understand and apply fuzzy controllers to solve real-world civil engineering problems.
4. explain basic concepts of support vector machines and choose appropriate techniques relevant to civil engineering.
5. develop a regression models for civil engineering problems.

UNIT I:

Introduction: introduction, brief history, intelligent systems: ELIZA, categorization of intelligent systems, components of AI program. Foundations of AI, sub areas of AI, applications, current trends in AI.

UNIT II:

Artificial Neural Networks: introduction, artificial neural networks: neuron model, activation functions, neural network architecture. Single layer feed forward networks, multi-layer feed forward networks, radial basis function networks, design issues of artificial neural networks, recurrent networks.

Applications: construction technology evaluation, predicting carbonation depth in concrete structures, optimal calibration of water distribution systems, traffic control system for isolated intersections, classification of pavement surface distress, back calculation of flexible pavement moduli from falling weight deflectometer data, back calculation of pavement profiles from the Spectral analysis of surface waves test

UNIT III:

Fuzzy sets and fuzzy logic: introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules, fuzzy systems.

Applications: pipe networks, real time reservoir operation, evaluation of existing reinforced concrete bridges, optimization of steel structures, diagnosing cracks in RC structures, construction scheduling, wastewater treatment systems, pavement cracking detection, road accident analysis

UNIT IV:

Machine learning: introduction, machine learning systems, supervise and unsupervised learning, inductive and deductive learning, clustering, support vector machines

Applications: slope stability analysis, settlement of shallow foundations on cohesionlesssoils, evaporate losses in reservoirs, undrained shear strength of clay, prediction of compressive strength of self-compacting concrete, traffic signal coordination.

UNIT V:

Regression Analysis: Relationship between attributes using Covariance and Correlation, Relationship between multiple variables: Regression (Linear, Multivariate) in prediction. Residual Analysis, Hypothesis testing of Regression Model, R-square and goodness of fit, Multiple Linear Regression, Non-Linear Regression, logistic regression.

Applications: determination of uniaxial compressive strength and modulus of elasticity, prediction of fracture parameters of concrete, choose alternative route by optimization in transportation, capacity of signalized and unsignalized intersections, choose different mode by cost optimization.

Text Books:

1. PijushSamui, DwarkadasPralhaddas Kothari, Artificial intelligence in Civil Engineering: AI in Civil Engineering, 2012.
2. Ian Flood, Nabil Kartam, Artificial Neural Networks for Civil Engineers: advanced features and applications, 1998.

Suggested Reading:

1. S.M Yadav, Application of soft computing techniques in civil engineering, 2018.
2. SarojKaushik, "*Artificial Intelligence*", Cengage Learning India, 2012.
3. Nelson M. Mattos, "*An Approach to Knowledge Base Management*", Springer Berlin Heidelberg, 1991.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

18CE C22

ENVIRONMENTAL ENGINEERING LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The objectives of the course are to

1. Perform the experiments using different equipments
2. Determine water quality using standard test procedures
3. Understand the water & waste water sampling, their quality standards
4. Estimate air quality and classify the level of pollution
5. Estimate bacteriological quality of water.

Course outcomes: After the completion of the course student should be able to

1. Demonstrate skills to use equipments in conducting the test procedures.
2. Evaluate water quality and summarize the suitability in accordance with IS: 10500- 2012, Drinking Water specifications.
3. Evaluate characteristics of wastewater and summarize the suitability for disposal/reuse as per standards.
4. Measure air quality and classify the level of pollution based on standards set by Pollution Control Board.
5. Evaluate and analyse bacteriological quality of water**.**

Practical Work: List of Experiments

1. Determination of pH, turbidity
2. Determination of Electrical Conductivity
3. Determination of Total Solids (Organic and inorganic, volatile and fixed)
4. Determination of Alkalinity
5. Determination of Hardness (Total, Calcium and Magnesium Hardness)
6. Determination of Chlorides and sulphates
7. Determination of optimum coagulant Dosage
8. Determination of COD
9. Determination of DO and BOD
10. Determination of Breakpoint chlorination
11. Determination of MPN
12. Measurement of air quality

Suggested Reading:

1. Government of India & Government of The Netherlands –Hydrology Project Technical Assistance, “Standardanalytical procedures for water analysis”, May 1999

2. D. R. Khanna and R. Bhutiani, “Laboratory Manual of Water and Wastewater Analysis”, Daya Publishing House, 2008

18CE C23

ENGINEERING GEOLOGY LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	35 Marks
CIE	15Marks
Credits	1

Course Objectives: The students will:

1. Familiarize with the procedures for the identification of minerals rocks and
2. Describe different structural models.
3. Measure the attitude of beds and draw the sections for geological maps.
4. Operate electrical resistivity meter.
5. Describe the various types of maps.

Course Outcomes: Upon the Completion of this course students will be able to

1. identify the minerals, rocks and various
2. identify structural features like folds, faults and unconformities.
3. measure the electrical resistivity of rocks, soil etc.
4. interpret the topographic maps.
5. identify the geological and geotechnical features of given places.

LIST OF EXPERIMENTS:

1. Identification and description of physical properties of minerals.
2. Identification and description of Geotechnical characteristics of Rocks.
IS 1123-1975
3. Study of structural models, folds, faults and unconformities.
4. Measurement of strike and dip of joints in granites using clinometers compass.
5. Measurement of electrical resistivity of rocks, soils and water.
6. Study of geological and Geotechnical map of Telangana, Andhra Pradesh and India.
7. Study of Topographic Maps of Srisailam and NagarunaSagar dams.
8. Study of maps and sections pertaining to the study of folds, faults and unconformities.

Suggested Reading:

1. IS 113-1975, "*Methodof Identification of natural Building stones*", Bureau of Indian Standards.
2. Parbinsingh, "*Engineering and general Geology*", S.K.Kataria& sons, New Delhi 2010.
3. F. G. Bell, "*Fundamentals of Engineering Geology*", Aditya Books Pvt. Ltd., New Delhi 2007
4. "*Seismo Tectonic Map of India*", Geological Survey of India 2005.
5. Kuzin M., Egorov N., "*Field Manual of Minerals*", Central Books
Ltd., 1997.

16CE C34

WATER RESOURCES ENGINEERING - II

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the students to understand

1. Storage head works, selection, and stability analysis. Finalize profile of a gravity dam.
2. Types of dams, seepage analysis, design criteria of an earth dam.
3. Types of spillways, selection, energy dissipaters and spillway gates.
4. Understand water power engineering, hydel plant layout and components.
5. Comprehend minor irrigation, river engineering, and water resources management.

Course outcomes: At the End of the course, the student will be able to

1. Analyze and design a non-overflow gravity dam
2. Design a typical earth dam as per criteria.
3. Formulate a spillway proposal with appurtenant energy dissipaters.
4. Prepare a preliminary proposal of hydel plant for a given site.
5. Know about minor irrigation and formulate it. Plan for the river training work, water resources management.

UNIT – I:

Storage Head Works : Types of dams, advantages and disadvantages, selection criteria, Economical height of the dam, Gravity dams, Forces acting on dam, stability analysis, Principal stresses, Elementary Profile and Practical Profile, Low and High Gravity dams, joints, galleries, foundation grouting.

UNIT – II:

Earth Dams: Types, methods of construction, Seepage analysis for homogeneous and zoned embankment dams, Drainage in embankment dams, failure of Earth dams & Design Criteria.

Various types of filters, filter criteria and design. Stability of slopes during steady seepage, sudden drawdown condition, failure due to pore pressure during construction of dam.

UNIT – III:

Spill Ways and Energy Dissipation: Types of Spill Ways, Ogee Spill ways, Design of Ogee Profile, Fixation of levels, Syphon Spill Way & Chute Spill Way. Energy Dissipaters, Hydraulic Jump & Bucket type dissipaters, Tail water rating curve & Jump Height Curve, Spillway gates.

UNIT- IV:

Water Power Engineering: History, demand and generation, comparison hydel and thermal power, types of Hydel Plants, Water Conveyance, Penstocks & Surge tanks, powerhouse layout and components – their functions, flow and power duration curves. Load factor, utilization factor, capacity factor.

Power House: Substructure and super structure of a power house, merits and demerits of an underground power house, fixation of dimensions of a power house.

UNIT- V:

Minor Irrigation: Role and importance of minor Irrigation, delineation of catchment area, free and intercepted catchment, components of minor Irrigation

River engineering: Classification of rivers, meandering process, river training, types of training works.

Water resources management: Integrated river basin planning and management, warabandi, farmer's participation in water management, strategies and problems in water resources management, Interlinking of rivers.

Text Books:

1. P. N. Modi, “*Irrigation Water Resources and Water Power Engineering*”, Standard Publishers, New Delhi, 2014.
2. S. K. Garg, “*Irrigation Engineering & Hydraulic Structures*”, Khanna Publishers, New Delhi, 2017.

Suggested Reading:

1. Ralph A.Wurbs and Wesley.P.James, “*Water Resources Engineering*”, Pearson, New Delhi, 2015
2. M. M. Dandekar&K. N. Sharma, “*Water Power Engineering*”, Vikas Publishers, New Delhi, 2016.
3. Challa, Satya N Murthy., “*Water Resources Engineering*”, New Age International, New Delhi ,2002.

16CE C35

DESIGN OF STEEL STRUCTURES -I

Instruction	4(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: To enable the students

1. Learn and apply the design philosophies(working stress method and limit state method) for various steel structural components and their connections, as per the relevant standards
2. To understand the behaviour of compression members and design column bases
3. To understand the modes of failure of tension members.
4. To understand the behaviour of flexural members in the industry.
5. Learn the Behaviour of trusses and design of purlins.

Course Outcomes: At the end of the course, the student

1. Attains fundamental knowledge of the design of various Steel Structures, connections and is able to interpret the specifications of relevant codes.
2. Able to design compression members & column bases.
3. Able to understand the behaviour of tension members and its design.
4. Able to understand the classification of beam section, local failure of section and design of flexural members.
5. Able to estimate the loading roof trusses and design of purlins.

UNIT – I:

Materials and Specifications: Chemical composition of steel, types of Structural Steel - classification of Rolled Steel Sections.

Design Philosophies: Working Stress Method, Limit State Method,

Loads and Load Combinations: Design Loads & load Combinations; Characteristic Loads, Partial safety factors for materials and loads.

Bolted Connections (Limit State Method): Lap & Butt joints and the behaviour of Bolted Joints -Modes of failure - Design of Bolted joints using ordinary Black Bolts - Concentric Connections and Eccentric Connections – Connections using High Strength Friction Grip Bolts.

Welded Connections (Limit State Method): Lap and Butt Joints- strength of welded joints -design of welded joints - Concentric Connections and Eccentric Connections.

UNIT – II:

Design of Compression Members (Limit State Method): Introduction, Buckling &yielding phenomena, Sections used for compression Members. Effective Length of Compression Members, Design of Compression Members with single section and Built-up Sections (Symmetric in both directions), Lacing and Battening, Column Splices.

Design of Column Bases: Design of Slab and Gusset Bases.

UNIT – III:

Design of tension members (Limit State Method): Introduction to tension members - Applications of tension members, Modes of Failure, Design of Tension Members – Design of Lug Angles - Staggered bolting.

Working Stress Method (as per IS 800-2007): Permissible Stresses, Slenderness Ratio, Design of tension members, Design of Simple Compression Members.

UNIT – IV:

Design of Beams (Limit State Method) : Introduction to Plastic Analysis – Plastic Hinge, Plastic moment, Shape factor; Classification of Cross Sections, Phenomenon of Lateral Torsional Buckling; Design of Laterally Supported beams and laterally Unsupported Beams, Secondary considerations - Check for Web crippling, web buckling and deflection .

UNIT – V:

Design of Roof trusses (Limit State Method): Types of trusses, Estimation of loads- dead load, live load and wind load, Design of purlins, Analysis and design of roof trusses with angle sections.

Text Books:

1. N. Subramanian, "*Design of Steel Structures",* Oxford University Press, 2008.
2. S. K. Duggal, "*Design of Steel Structures*", 2^{nd} Edition, Tata McGraw Hill Publishing, 2014.

Suggested Reading:

1. S. S. Bhavikatti, "*Design of steel Structures*", 3^{rd} Edition, I.K. International Publishing House Pvt. Ltd. 2012.
2. IS 800:2007,"*Indian Standard General Construction in Steel- Code of Practice*". (Third revision).

16CE C36

ESTIMATION AND SPECIFICATIONS

Instruction	4(3L+1T) Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course objectives: To enable the students understand

1. The working of detailed estimates for different structures.
2. The working of steel quantities of R.C.C Framed works and preparation of BBS
3. The rate Analysis for different items of works.
4. About TSDSS and Departmental procedures.
5. About Specifications and standard procedure for construction works.

Course outcomes: At the End of the course the students should be able to

1. Prepare detailed estimates for different structures.
2. Prepare the detailed estimate steel qualities of RCC framed works and to prepare BBS.
3. Do the rate analysis for different items of works of buildings, concrete and bituminous road works.
4. Apply TSDSS and departmental procedures.
5. Work out standard procedure and specifications of construction works.

UNIT – I:

Introduction of estimation, object of estimation, factors influencing estimation, types of estimates, Detailed estimated for Flat roof building (load bearing and RCC framed) - long and short wall method - centre line method.

UNIT – II:

Estimation of steel quantities and preparation of bar bending schedule (BBS) - RCC framed works - Slabs (one way and two way), Beams and columns, footings, stair case Retaining wall.

UNIT – III:

Detailed estimate of road works for Bituminous, WBM roads and CC road (including earth work), single cell rectangular box culvert, Septic tank and earth work of irrigation canals.

UNIT – IV:

Preparation of analysis of rates and theoretical requirements of materials as per the Telangana State Standard Data and Schedule of Rates, for major items of works of a building, all items of work of Bituminous and concrete road works.

UNIT – V:

General and detailed specifications of works as per Telangana State Standard Data and Schedule of Rates, Departmental procedure for construction work, Measurement Book and Muster Roll.

Text Books:

1. B. N. Dutta, "*Estimating and Costing in Civil Engineering – Theory and Practice*", UBS, publishers' distributors (p) ltd.-New Delhi 2012.
2. M. Chakraborti, "*Estimating, Costing, Specifications and Valuation in Civil Engineering"*, Chakraborti 2006.

Suggested Reading:

1. Jagjit Singh, "*Estimating and Costing in Civil Engineering*", Galgotia Publications, New Delhi, 1996.
2. B. S. Patil," *Civil Engineering Contracts and Estimation*", Orient Black swan Private Ltd; Fourth edition 2015.
3. Standard Scheduled Rates and Relevant BIS Codes

16CE E07

ADVANCED REINFORCED CONCRETE DESIGN
(ELECTIVE – III)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. To understand the concepts of beams curved in plan along with analysis and design.
2. To understand the Analysis and Design and Detailing of Deep Beams.
3. To understand the behaviour of portal frames, Bunkers, silos and their design.
4. To understand the design principles of Flat Slabs and grid slabs.
5. To understand the structural behaviour and design principles of Raft and Pile.

Course Outcomes: Upon the completion of this course, the student should be able to

1. Analyse and Design beams curved in plan as per the field requirements.
2. Design simply supported and continuous deep beams.
3. Analyse, design and detail the Bunkers, silos and portal frames.
4. Analyse and design flat slabs and grid slabs using the codal provisions.
5. Predict structural behaviour of Raft, and Pile foundations and design them.

UNIT – I:
Beams curved in plan: Introduction–Design Principles–Structural Design of rectangular beams circular in plan and rectangular in cross-section, continuously supported on 'n' number of symmetrically spaced columns.

UNIT – II:
Deep Beams: Introduction–flexural and shear stresses in deep beams.–I.S. Code provisions – Design of simply supported and continuous Deep beams.
Building Frames: Analysis of Multistorey building frames subjected to gravity loads using Substitute frame method and Design.

UNIT – III:
Bunkers and Silos: Introduction, design principles and theories, IS code provisions, design of Rectangular bunkers and cylindrical silos.

UNIT – IV:
Flat slabs: Introduction, Components- I.S. Codal Provisions–Design principles and methods – Direct design method, Equivalent frame method and Design for flexure and shear.

UNIT – V:
Raft Foundations: Definitions, types**,** design of Raft foundation -flat plate type and beam slab type for buildings with column grids up to three by three.
Pile Foundations: Structural design of Pile and Pile caps.

Text Books:

1. N. Krishna Raju, "*Advanced Reinforced Concrete Design*", CBS Publishers, 2016.
2. H.J. Shah," *Reinforced Concrete Vol-I and Vol-II"*, Charotar Publishers, 2016 and 2014.

Suggested Reading:

1. P. C. Varghese, "*Advanced Reinforced Concrete Design*", PHI, 2005.
2. B. C. Punmia and Ashok Kumar Jain, "*Comprehensive R.C.C. Designs*", Laxmi Publishers 2005.

16CE E08

ADVANCED ENVIRONMENTAL ENGINEERING
(ELECTIVE - III)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student

1. Understand the characteristics and effects of industrial effluents & legislation regarding effluent disposal
2. Understand manufacturing process and effluent treatment of various industries
3. Comprehend and monitor ambient air quality in order to assess the pollutants.
4. Understand the methods of air pollution control and selection of equipment for the control.
5. Understand the need and objectives of Environmental Impact Assessment (EIA), impacts of road projects, industries and dams.

Course Outcomes: At the end of the course, the student will be able to

1. Characterize the effluents, analyze the effects of industrial effluents on the human health & thoroughly practice environmental legislation
2. Apply the methods of Industrial waste water management and treatment.
3. Evaluate, monitor and analyze ambient air quality.
4. Apply the methods of air pollution control to field situations.
5. Evaluate the impact of road project, industry and a dam on the surrounding environment.

UNIT – I:

Industrial waste Management: Types of industries, characteristics of Industrial wastes, effects of industrial effluents on streams, land and human health. Environmental legislation related to Industrial effluents and hazardous wastes. Self-purification of water bodies, Streeter Phelps Equation.

UNIT – II:

Industrial Waste Water treatment: Manufacturing process, waste water characteristics and effluent treatment of the following industries- leather tanning, dairy, pulp and paper, pharmaceutical, textiles, steel plants, thermal power plants, fertilizer, cement, sugar and distilleries.

UNIT – III:

Air pollution: Sources, classification and effects of air pollutants, Meteorology of air pollution, wind rose diagrams, lapse rates, atmospheric stability an dispersion of air pollutants, stack height calculation, ambient air quality monitoring, stack sampling, analysis of air pollutants.

UNIT- IV:

Air Pollution Control: Air quality standards, methods of air pollution control – zoning, source correction, control of suspended particulate meter by equipment (gravitation, centrifugation, flirtation, scrubbing, electrostatic precipitation), selection of proper equipment, gaseous pollutant control by adsorption, condensation, combustion.
Noise Pollution: Sources, measurement and various control methods.

UNIT – V:

Environmental Impact Assessment: Need for environmental impact assessment (EIA), objectives of EIA, EIA capabilities and limitations. Legal provisions of EIA, Base line at a collection required for EIA, Evaluation of impacts, Prediction of impacts, Preparation of Environmental Management Plan, Preparation of EIAs of road project, Industry, and dam. Issues related to rehabilitation of affected people, Preparation of Environment, Impact statement and Environment Management Plan.

Text Books:

1. M. N. Rao and Dutta, "*Waste Water Treatment",* Oxford and IBM Publications Ltd., 2017.
2. W. W. Eckenfelder, "*Industrial Water Pollution C*ontrol", Mc Graw Hill India, 2005.
3. M.N. Rao, H.V.N. Rao, "*Air Pollution Control*", Tata Mc Graw Hill, 2017

Suggested Reading:

1. C. S. Rao, "*Environmental Pollution Control Engg"*, New Age International Publishers, 2018.
2. Peavy and Rowe, "*Environmental Engg",* McGraw Hill Publications, 2017.
3. Keiley, "*Environmental Engg*", Mc Graw Hill Publishers, 2003.

PROFESSOR & HEAD
Department of Civil Engineering

16CE E09

GROUND IMPROVEMENT TECHNIQUES
(ELECTIVE - III)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To make the students understand

1. The importance of ground improvement and learn about various types of ground improvement techniques available to date, and selecting and designing suitable ground improvement technique for given soil conditions.
2. The concepts behind a range of ground improvement and soil remediation techniques.
3. The different concepts of dewatering procedures, soil stabilization, grouting in soils, consolidation and shear strength of the soil.
4. The Types, functions and applications of Geo-textiles, geo-grid, tests on geo-textiles and Reinforced earth.
5. The advantages, disadvantages, and limitations for each ground improvement techniques.

Course Outcomes: At the end of the course, the student would

1. Know the importance of ground improvement techniques and types of techniques for different soils.
2. Apply the various ground improvement techniques to address the field problems.
3. Understand the degree to which soil properties may be improved; and the benefits involved
4. Identify suitable ground improvement technique for specific project and its implications.
5. Design ground improvement techniques as well as be able to advice regarding value engineering to save cost and obtain maximum benefits for the specific project

UNIT- I:
Introduction: Need for ground improvement, applications, and factors affecting–different mechanical, chemical, static and dynamic techniques – mechanical stabilization – blending of aggregate – RothfutchTesting. Concept of Soil confinement, Gabion Walls, Crib Walls and Sand Bags.

UNIT – II:
Chemical stabilization: Lime, Cement, Bitumen, Emulsions, Chemicals, factors influencing–Design approach, construction procedure, laboratory testing, additives. Suspension and solution grouts, Principles, method, equipment, applications, compaction grouting, jet grouting, field compaction control.

UNIT – III:
Stabilization of Cohesion less soils: In Situ densification, Vibro techniques–Mechanisms. Factors affecting, suitability number, compacting piles. Vibro replacement process, Vibro flotation process, Terra Probe Method, Dynamic Compaction.

UNIT- IV:
Stabilization of Cohesive soils: In Situ densification, Pre-loading–Dewatering–sand drains. Sand wicks, geo-drains, rope-drains, band-drains, stone columns, and lime piles, thermal and vacuum methods.
Treatment of Expansive Soils: Expansive Soils- parameters of expansive soils and their classification- moisture changes in expansive soils - Design of foundations in expansive soils - CNS technique.

UNIT – V:
Ground treatment for Slopes: Different types of in-situ soil stabilization like soil nailing, anchoring, pre-stressed anchoring - design methods and construction techniques.
Geo-textiles: Woven and non-woven fabrics. Types, functions and applications–Geo-textiles, geo-grids test on geo-textiles, Reinforced earth – Principles and factors governing design.

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Text Books:

1. P.Purushothama Raju, "*Ground Improvement Techniques*", Laxmi publications 2016.
2. K.R Arora, *"Soil Mechanics and Foundation Engineering",* 5th Edition, Standard Publishers, 2005.

Suggested Reading:

1. Nihar Ranjan Patra, "*Ground Improvement Techniques*", Vikas publishing house Pvt. Ltd, 2012.
2. R. Hausmann*., "Engineering Principles of Ground Modification"*, McGraw Hill Publishing Co.,2013.
3. H. Fang*," Foundation Engineering Hand Book*", 2nd Edition, CBS Publication, New Delhi, 2004.
4. G. V. Rao and G. V. S. S. Raju, "*Engineering with Geosynthetics",* McGraw Hill Education, 1998
5. IRC-SP 58 (2001): "*Guidelines for use of fly ash in road embankments*".

16CE E10

ELEMENTS OF EARTH QUAKE ENGINEERING
(ELECTIVE-IV)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the student

1. Understand the causes of earthquakes , their Magnitude & effects and various types of earthquake waves
2. Understand the concepts of damped and un damped vibrations and the response of single , two and multi-degree systems to these vibrations , and concepts of Response spectrum
3. Review various case studies of past earthquakes , and performance of buildings during those earthquakes, understand the concepts of Seismic Design Philosophy and Earthquake Resistant Design of Masonry , RC and Steel structure
4. Gain knowledge of Seismic Performance of Engineered and Non-Engineered Urban and Rural buildings
5. Understand the basic concepts of Seismic resistant construction , Base isolation techniques and other energy dissipation devices and Concepts of Seismic retrofitting

Course outcomes: At the end of the course, the student is able to

1. Assess the cause of an earthquake , it's magnitude and its effects on structures
2. Apply the concepts of Damped and Un-damped Vibrations to single , two and multi-degree systems and deduce a response spectrum
3. Apply the concepts of Seismic Design Philosophy and Earthquake Resistant Design to Masonry , RC and Steel structures
4. Evaluate the Seismic Performance of Engineered and Non-Engineered Urban and Rural buildings
5. Apply the concepts of Seismic Resistant Construction , Base isolation techniques and other energy dissipating devices and also the concepts of Seismic Retro fitting, use and interpret the knowledge gained from the case studies of performance of buildings during past earthquakes

UNIT – I:
Engineering Seismology: Causes of earthquakes–Seismic waves-Magnitude, Intensity and Energy release – characteristics of strong earthquake ground motions – Soil effects and Liquefaction. Seismic Zonation of India, Seismic Instruments.

UNIT – II:
Theory of Vibrations: Introduction to theory of vibrations, Equations of motion – single degree of freedom (SDOF) systems, free and forced vibrations. Concepts of damped and undamped vibrations.

UNIT – III:
Multi degree of freedom (MDOF) system: Equation of Motion, Modal analysis - generation of modal frequencies and mode shapes, construction of response spectrum.

UNIT – IV:
Seismic Design Philosophy: Concept of Seismic resistant design, reduction factors– Over strength, Ductility and Redundancy –Determination of earthquake forces on buildings – Equivalent static method and Response spectrum method.

UNIT – V:
Seismic Performance of Buildings: Case Studies* of a few severe earthquakes in the country - Damages to buildings – Damage Patterns – Performance of Non-Engineered Buildings, Rural houses during the Earthquakes.
Concepts of earthquake resistant constructions in rural area. Base isolation and energy dissipation devices. Principles of Seismic Repair, rehabilitation and retrofitting.

- Students are made to discuss case studies in groups.

Text Books:

1. Pankaj Agarwal and Manish Shrikhande, "*Earthquake Resistant Design of Structures*", Prentice Hall of India Pvt. Ltd, 2006
2. S. K. Duggal, "Earthquake *Resistant Design of Structures*", Oxford publishers, 2013.

Suggested Reading:

1. A.K. Chopra, "*Dynamics of Structures*", Pearson Education, 2012.
2. A.R Chandrasekaran, J. Krishna, B. Chandra, "*Elements of Earthquake Engineering*", South Asian Publishers Pvt. Ltd, 2000.
3. Steven L Kramer, "Geo-*Technical Earthquake Engineering",* Pearson Education Ltd, 2013.
4. NPTEL notes.

16CE E11

ADVANCED TRANSPORTATION ENGINEERING
(ELECTIVE – IV)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the student

1. Understand the various materials and methods used for soil stabilization for roads.
2. Learn and apply the basic design principles for rigid and flexible pavements.
3. Evaluate the distress in highways, capacity of highways, transport cost and economy of a Highway..
4. Know the travel demand and management concepts and use computer applications for traffic and transport planning.

Course Outcomes: At the end of the course, the student should be

1. Able to apply various materials and methods for soil stabilization of roads.
2. Able to design a Rigid and flexible pavement.
3. Able to evaluate a highway for its distress, skid resistance, structural strength and drainage.
4. Able to assess the capacity and economic viability of a highway and also conduct transport cost-benefit analysis.
5. Able to apply the travel demand management concepts and use computer applications for traffic and transport planning.

UNIT- I:
Soil – Stabilized Road: Preliminary investigation, materials, Techniques of stabilizations, Methods of stabilization, Mechanical, Soil Cement, Soil Bitumen, Soil-fly ash -Lime Stabilization.

UNIT- II:
Pavement design: Factors affecting pavement design, Concepts of ESWL, flexible pavements-GI method-CBR method-IRC 37 2018, Rigid pavement design-IRC 58 2015.

UNIT- III:
Pavement Evaluation: Pavement distress**,** Skid resistance, structural evaluation, Benkelman beam method, Overlays, Highway drainage – importance, requirements surface drainage system, sub-surface drainage system.

UNIT- IV:
Highway capacity and Economic evaluation: Passenger car units (IRC), Level of service–concept, factors, multilane capacities for rural, urban, and express ways.

Concept of – Transport cost & benefits: Benefit cost ratio, net present value, rate of return, and their relative comparison for evaluation. Accidents – causes, methodologies for accident costing precautions to minimize the accidents.

UNIT- V:
Travel demand management: Traffic Management Systems (TMS)–Restrictions on turning movements, One way streets, tidal flow – Operations, Exclusive bus lanes. Traffic Relief at junctions, at plane, parking studies, parking inventories, types of parking service, parking analysis, bottle necks.
Nature of traffic problems in cities Effect on environment due to traffic noise and air pollution. Introduction of Computer applications in traffic and transport planning.

Text Books:

1. L. R. Kadiyali, “*Traffic Engineering and Transportation Planning*”, Khanna Publications, 2011.
2. S. K. Sharma, “*Principles, Practice and Design of Highway Engineering”,* S. Chand & Company, 2014

Suggested Reading:

1. G. V. Rao,” *Principles of transportation and Highway Engineering*”, McGraw Hill Education India Pvt. Ltd, 2000.
2. S.K. Khanna and C.E. Justo, “*Highway Engineering*”, Nem Chand & Sons, 2017.
3. S.C. Saxena,”*Text book Highway and Traffic Engineering*”, CBS 2005.

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16CE E12

DESIGN AND DETAILING OF IRRIGATION STRUCTURES (ELECTIVE - IV)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The student should be able to understand the

1. Principles of a surplus weir
2. Design of direct sluice
3. Basic principles of glacis type canal drop
4. Basic principles of Design of Cross regulator
5. Design of super passage.

Course Outcomes: The Student will be able to design procedures and detail a

1. Surplus weir
2. Direct sluice
3. Glacis type canal drop
4. Cross regulator
5. Super passage.

UNIT – I:
Surplus Weir: - Components of surplus weir - computation of flood discharge - Design of surplus weir & detailing

UNIT- II:
Direct Sluice:-Hydraulic particulars - General arrangements of various components - Design of vent way, Sluice barrel, Head walls, Wing Walls and return walls - Detailing

UNIT- III:
Glacis type Canal Drop:- Components, General arrangements, Fluming ratio, fixing the crest level, length of weir, U/S and D/S glacis, Transitions - Protection works - Curtain wall, Energy dissipation arrangements - Design & Detailing

UNIT- IV:
Cross Regulator: General design principles - General arrangements of various components - design of vent way by drowning ratio - arrangements of energy dissipation - U/S & D/S protection works - Design & Detailing.

UNIT-V:
Super Passage:- Hydraulic particulars of drain & Canal - U/S & D/S transitions -TEL's - fixing vent way - design of trough - Afflux in the canal - Proposal sketch of the super passage including transitions. Concepts of Syphon design.

Text Books:

1. B.C. Punmia, "*Irrigation & Water Power Engineering*", Lakshmi Publications, Delhi, 2016.
2. Ch. S. N. Murthy, "*Water Resources Engineering*: Principles and Practice", New Age International Publishers, Delhi, 2002.

Suggested Reading:

1. R.S. Varshney, S.C. Gupta, R.L. Gupta, "*Theory & Design Of Irrigation Structures Vol. 1*", Nem Chand & Brothers, 1992
2. S. K. Garg, "*Irrigation Engineering and Hydraulic Structures*", Khanna Publishers, New Delhi, 2017.

16CS O06

FUNDAMENTALS OF DBMS
(ELECTIVE – V)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: File Structures.

Course Objectives: The main objectives of this course are:

1. To learn data models, conceptualize and depict a database system using E-R diagram.
2. To understand the internal storage structures in a physical DB design.
3. To know the fundamental concepts of transaction processing techniques.

Course Outcomes: On Successful completion of this course, student will be able to:

1. Understand the find fundamental components of the DBMS.
2. Design the database schema and develop E-R model.
3. Devise queries using relational algebra and SQL.
4. Apply normalization techniques and solve problems using various Indexing techniques.
5. Understand transaction processing, Concurrency control and recovery techniques.

UNIT – I:

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures. **Database Design and E-R Model:** Basic concepts, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT – II:

Relational Model: Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Fundamental Operations.
Structured Query Language: Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT – III:

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT – IV:

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files.
Transaction Management: Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT – V:

Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery.
Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions.

PROFESSOR & HEAD

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "*Database System Concepts*", Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, "*An Introduction to Database Systems*", Eight Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, Johnnes Gehrke, "*Database Management Systems*", Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, "*Fundamentals of Database Systems*", Fourth Edition, Pearson Education,2006.

16ME O01

ENTREPRENEURSHIP
(ELECTIVE – V)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand
1. The environment of industry and related opportunities and challenges
2. Concept and procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Outcomes: After completing this course, students will be able to:
1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

UNIT-I:
Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT-II:
Identification and Characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT-III:
Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT-IV:
Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V:
Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior
Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, "*Dynamics of Entrepreneurial Development and Management*", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "*Project-Planning, Analysis, Selection, Implementation and Review*", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "*Entrepreneurial Development*", S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, "*Entrepreneurship"*, 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, "*First Things First*", Simon and Schuster Publication, 1994.
3. Sudha G.S., "*Organizational Behavior"*, National Publishing House, 1996.

16EG O01

TECHNICAL WRITINGS SKILLS
(ELECTIVE – V)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The course will introduce the students to
1. Process of communication and channels of communication in general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

Course Outcomes: After successful completion of the course students will be able to
1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

UNIT- I:
Communication – Nature and process.
Channels of Communicational: Downward, upward and horizontal communication. Barriers to communication.
Technical Communication: Definition, oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication.
Technical communication Skills – Listening, Speaking, Reading & Writing.

UNIT –II:
Technical Writing: Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

UNIT- III:
Business correspondence: Sales letters, letters of Quotation, Claim and Adjustment letters.
Technical Articles : Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

UNIT- IV:
Technical Reports: Types, significance, structure, style and writing of reports. Routine reports, Project reports.
Technical Proposals:: Definition, types, characteristics, structure and significance.

UNIT- V:
Mechanics of Meetings: Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.
Technical Presentations: Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Text Book :

PROFESSOR & HEAD

1. Meenakshi Raman andSangeeta Sharma, **“***Technical Communications-Principles and Practice***”,** Oxford University Press, Second Edition, 2012.
2. I..M Ashraf Rizvi, **“***Effective Technical Communication***”,** Tata McGraw Hill Education Pvt. Ltd, 2012.

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16EE O02

ENERGY MANAGEMENT SYSTEMS
(ELECTIVE – V)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: The course will introduce the students to
1. To know the concept of Energy management
2. To understand the formulation of efficiency for various engineering systems
3. To explore the different ways to design various technologies for efficient engineering systems.

Course Outcomes: After completion of this course, students will able to:
1. Know the current energy scenario and importance of energy conservation.
2. Understand the concepts of energy management.
3. Evaluate the performance of existing engineering systems
4. Explore the methods of improving energy efficiency in different engineering systems
5. Design different energy efficient devices.

UNIT-I:
BASICS OF ENERGY AND ITS VARIOUS FORMS: Overview of engineering, elements Solar energy, electricity generation methods using solar energy, PV cell, elements of wind energy, electricity generation using wind energy, elements of bio energy, bio mass energy conservation, elements of geothermal energy, sources of geothermal energy, sources of chemical energy, fuel cells, Energy Scenario in India

UNIT-II:
Energy Management - I: Defining Energy management, need for energy management, energy management techniques, importance of energy management, managing the energy consumption, energy crisis, environmental aspects

UNIT-III:
Energy Management-II: Energy management approach, understanding energy costs, bench marking, energy performance, matching energy use to requirement, optimizing the input, energy requirements, energy audit instruments, material and energy balance diagrams, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, restructuring of the energy supply sector, energy strategy for the future

UNIT-IV:
Energy Efficient Technologies-I: Importance of energy efficiency for engineers, Energy efficient technology in mechanical engineering: Heating, ventilation and air-conditioning, boiler and steam distribution systems
Energy efficient technology in civil engineering: future of roads, harnessing road and transport infrastructure;

UNIT-V:
Energy Efficient Technologies-II: Energy efficient technology in electrical engineering: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors; Energy efficient technology in chemical engineering: green chemistry, low carbon cements, recycling paper

Text Books:

1. UmeshRathore, *'Energy Management'*, Kataria publications, 2nd edition, 2014.
2. "*Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects*".

3.Hargroves, K., Gockowiak, K., Wilson, K., Lawry, N., and Desha, C. (2014), "*An Overview of Energy Efficiency Opportunities in Mechanical/civil/electrical/chemical Engineering*", The University of Adelaide and Queensland University of Technology.

Suggested Reading:

1."*Success stories of Energy Conservation",* BEE, New Delhi (www.bee-india.org)
2. K V Shama, P Venkataseshaiah, "*Energy Management and Conservation*", I. K. International Publishing agency pvt. ltd., 2011, ISBN: 978-93-81141-29-8

16 CE C37

COMPUTER APPLICATIONS LAB

Instruction	3 Periods per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: To enable the students:

1. Gain exposure to a few software packages used in various areas of Civil Engineering (Structural Analysis & Design, Surveying, Water Supply & Sanitary Engineering, Water resources Engineering and Soil Mechanics) and the applications of these software packages.
2. Attain the fundamental knowledge of navigation of these software packages.
3. Acquire adequate conceptual knowledge and skills to use these software packages in the field in order to provide solutions to civil engineering problems
4. Provide accelerated/time bound solutions with help of these software packages without effecting the accuracy of computations
5. Understand the aspects of debugging, if errors occur while using these software packages

Course Outcomes: At the end of the course the students will be able to:

1. Model and analyse a framed structure and design all its components including isolated footings, using software.
2. Analyse pipe networks and sewer networks using software.
3. Estimate ground water flow head and velocity and also the pollutant concentration in ground water flow, using software.
4. Digitize topo sheets using GIS and also prepare Map overlays using GIS.
5. Analyse a natural slope using slope stability methods and design a cantilever retaining wall using software.

List of Exercises:

1. Modelling & analysis of framed structure.
2. Design of framed structure.
3. Design of isolated footing
4. Steady state analysis of pipe networks (open/looped) using EPANET.
5. Analysis of sewer networks.
6. Estimation of ground water flow head and velocity.
7. Estimation of pollutant concentration in groundwater flow - flow through porous media by using visual.
8. Digitization of topo sheets using GIS.
9. Map overlay using GIS.
10. Analysis of natural slope using Slope stability.
11. Design of cantilever retaining wall.

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16CE C38

PROJECT SEMINAR

Instruction		3 Hours per week
CIE	50 Marks	
Credits	2	

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks:

Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

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16CE E13

DESIGN OF STEEL STRUCTURES -II
(ELECTIVE – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Codes required: IS 800 – 2007, steel tables, Bridge rules, Bridge Code (Railways)

Course Objectives: To enable the students to
1. Gain exposure to a few basic types of steel structures (Plate Girders, Gantry girders, Trussed girders etc.) and their components, used in Highway bridges , Industrial workshops and Railway bridges .
2. Attain fundamental knowledge of design of plate girder, gantry girder, steel railway bridges (plate girder & truss girder type), rocker & roller bearings and is able to interpret the specifications of relevant codes.
3. Acquire adequate conceptual knowledge and skills to extend the same to investigate into critical issues , compare various options & choose best solution for the problems in the areas of highway , industrial and railway steel structures
4. Consider economy in the design of these structures without suffering the safety, in a given situation.
5. Understand the intricacies of detailing aspects of these structures and their connections

Course Outcomes: At the end of the course the students are able to
1. Design a welded plate girder for industrial and infrastructural purpose, as per the specifications of relevant codes
2. Design a gantry girder for industrial workshops as per the specifications of relevant codes
3. Design Roller & Rocker bearings for railway bridges
4. Design and detail a deck type riveted plate girder bridge using railway code and bridge rules
5. Design and detail a through type riveted truss girder bridge using railway code and bridge rules

UNIT- I:
Design of Plate girders: Design of welded plate girder for static loads–Economical Depth, Design of Cross Section, Flange curtailment, intermediate and bearing stiffeners, connections- As per IS 800-2007
UNIT- II:
Design of Gantry girders: Basic principles, Loads, Codal provisions, Detailed Design- Cross section and connections, Drawing- general layout and cross section;

UNIT- III:
Introduction to Railway Bridges and Design of bearings: Bridges: Deck and through type bridges – Economical span – Indian standard railway broad gauge train loadings – permissible stresses. Bearings: Types and general description of various bearings, detailed Design of Rocker and roller bearings for railway bridges.

UNIT- IV:
Design of Deck type riveted plate girder railway bridges: Economical depth, detailed design of Cross section, connections, intermediate and bearing stiffeners, Wind effects-Design of Cross frames Drawing-General layout, generation of longitudinal and cross sections

UNIT- V:
Design of Through type riveted truss girder railway bridges: Truss configurations, Detailed design of stringer beams, Cross girders and Truss girders; Wind effects- Design of top lateral and bottom Lateral bracing, Portal and sway bracings; Drawing-General layout , generation of longitudinal and cross sections.

Text Books:

1. S .K. Duggal, "*Design of Steel Structures, Limit State Method*", 2nd Edition, Tata McGraw Hill Publishing, 2014.
2. A.S Arya and J.L Ajmani, "*Design of Steel Structures*", Nem Chand & Bros, 2011.

Suggested Reading:

1. N. Subramanian, "*Design of Steel Structures, Limit State Method*", Oxford University Press, 2008.
2. Ramachandra and Virendra Gehlot, "*Design of Steel Structures*", Volume – 2, Scientific Publishers, 2008.
3. B.C. Punmia and Dr. Ashok Kumar Jain, "*Comprehensive Design of Steel Structures*", Laxmi Publications, 2015.

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16CE E14

ADVANCED STEEL DESIGN

(ELECTIVE – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Note: 1. IS Codes required: IS 800, Is 802, IS 805, IS 806, IS 1161.
2. For all units design philosophy is working stress method

Course Objectives: To enable the students to

1. Gain exposure to the concepts of a beam-column and grillage foundation with their applications
2. Attain fundamental knowledge on steel water tanks, understanding the codal provisions
3. Understand the significance and advantages of using tubular structures along with respective codal provisions
4. Acquire adequate conceptual knowledge on bunkers and silos and design them
5. Gain knowledge on transmission line towers, understand terminology and analyse them.

Course out comes: At the end of the course the students are able to

1. Analyse and design a beam-column and grillage foundation with detailing
2. Learn and apply the design concepts for the design of water tanks
3. To understand the nature of tubular section and their design.
4. To understand the behavior of Bunker's and Silo's and their design.
5. Learn apply basic principles of analysis of transmission towers, arrangement of member and design.

UNIT– I:

Beam Columns: Introduction, Design for Uni-axial and Bi-axial bending.

Grillage Foundations: Introduction, necessity of grillage foundations, various types, Design of Grillage foundations for axial loads under single and double columns.

UNIT- II:

Steel Tanks: Introduction, Types, loads, permissible stresses - detailed design of elevated rectangular mild steel and pressed steel tanks including staging.

UNIT- III:

Tubular Structures: Introduction – Advantages - Permissible Stresses - Design of tubular trusses - Design of tension members, compression members and flexural members including welded joints.

UNIT- IV:

Bunkers and Silos: introduction - general design principles- design theories - Janssen's Theory and Airy's Theory - Detailed design of rectangular bunkers and cylindrical silos.

UNIT- V:

Transmission Line Towers: Classification, economical spacing and design loads - IS code provisions - Calculation of wind loads and permissible stresses - Overall arrangement and design procedure - Detailed design including foundations

Text Books:

1. B.C. Punmia and Dr. Ashok Kumar Jain, "*Comprehensive Design of Steel Structures*", Laxmi Publications,2015.
2. S. Ramachandra and Virendra Gehlot, "*Design of Steel Structures Volume – 2*", Scientific Publishers, 2008.

Suggested Reading:

1. A.S Arya and J.L Ajmani, "*Design of Steel Structures*", Nem Chand & Bros.2011.
2. S. K. Duggal, "*Design of Steel Structures*", 3rd Edition, Tata McGraw Hill Publishing, 2017.
3. P. Dayaratnam by "*Design of Steel Structures*" Orient Longman, Pub.- 2012.
4. I.C. Sayal and S. Singh, by "*Design of Steel Structures",* Standard Pub. -2009.

16CE E15

INDUSTRIAL STRUCTURES
(ELECTIVE – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To impart knowledge about the fundamentals of load calculation, mechanical behavior, design and detailing aspects of

1. Steel Gantry Girders.
2. Steel Portal and Gable Frames.
3. Bunker and silo.
4. Steel Chimney.
5. Pre-engineered buildings

Course Outcomes: At the end of the course, the student will be able to

1. Develop an understanding in basic concepts in the Design of Steel Gantry Girders. Design in accordance with Relevant Indian Standard provisions to ensure safety and serviceability
2. Analyze and design with detailing for Steel Portal and Gable Frames according to specific codal criteria.
3. Differentiate between Bunker and silo, and design the Steel Bunkers and Silos on engineering concepts which are applied in field of Structural Engineering.
4. Understand the theoretical and practical aspects of Design of Steel Chimney along with the design aspects.
5. Analyse and design a pre-engineered industrial building.

UNIT- I:
Steel Gantry Girders: Introduction, Basic principles, loads acting on gantry girder, Codal provisions, , permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, Detailed Design of gantry girder - Cross section and connections, Drawing- general layout and cross section;

UNIT- II:
Portal Frames: Design of portal frame with hinge base, design of portal frame with fixed base - Gable Structures – Lightweight Structures

UNIT- III:
Steel Bunkers and Silos: Design of square bunker – Jansen's and Airy's theories – IS Code provisions – Design of side plates – Stiffeners – Hopper Bottom – Longitudinal beams. Design of cylindrical silo – Side plates – Ring girder – stiffeners.

UNIT- IV:
Steel Chimneys: Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of base plate, design of foundation bolts, design of foundation.

UNIT- V:
Pre-engineered buildings: Concepts of Pre-engineering and Pre-engineered buildings – Analysis and design of an industrial building using pre-engineered elements.

Text Books:

1. B.C. Punmia, K. K. Jain, and A. K. Jain, "*Design of Steel Structures*",., 2nd Ed., Laxmi Publishers,2015.
2. Ram Chandra, "*Design of Steel Structures*", Standard Publishers,2016.
3. Vivek K. S., Vyshnavi P, "Pre-Engineered Steel Building", Lap Lambert publishing, 2017.

Suggested Reading:

1. Subramanian, "*Design of Steel Structures*", Oxford University Press, 2106.
2. Alexander Newman, "Metal Building systems", McGraw Hill Education, 2014.

16ME O04

INTELLCTUAL PROPERTY RIGHTS

(ELECTIVE – VII)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will learn

1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

Outcomes: At the end of the course, a student

1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

UNIT-I:

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT

Patents: Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II:

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT-III:

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV:

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V:

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.

Unfair Competition: What is unfair competition? Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "*Indian Patents Law – Legal & Business Implications*", Macmillan India ltd , 2006
2. B. L.Wadehra; "*Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications*", Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan, *"Law of Copyright and Industrial Designs*", Eastern law House, Delhi 20

Suggested Reading:

1. W.R1 Cronish, "*Intellectual Property; Patents, copyright, Trad and Allied rights*", Sweet & Maxwell, 1993.
2. P. Narayanan, "*Intellectual Property Law*", Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, "*A Guide Book to Intellectual Property Patents, Trademarks*, Copy rights and designs", 4/e, Sweet, Maxwell,.

16EG O02

GENDER SENSITIZATION

(ELECTIVE – VII)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course will introduce the students to

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence.

Course Outcomes: After successful completion of the course the students will be able to

1. Develop a better understanding of important issues related to what gender is in contemporary India.
2. Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
4. Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice.
5. Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.

UNIT – I:
Understanding Gender:
Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)
Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)
Introduction.Preparing for Womanhood.Growing up Male.First lessons in Caste.DifferentMasculinities.

UNIT – II:
Gender And Biology:
Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)
Declining Sex Ratio.Demographic Consequences.
Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)
Two or Many?Struggles with Discrimination.

UNIT – III:
Gender andLabour:
Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)
"My Mother doesn't Work." "Share the Load."
Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)
Fact and Fiction.Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV:
Issues Of Violence
Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading:"*Chupulu*".
Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.
Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)
Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V:

Gender: Co - Existence
Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.
Additional Reading: Rosa Parks-The Brave Heart.

Textbook:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu **"***Towards a World of Equals: A Bilingual Textbook on Gende***r"** published by Telugu Akademi, Hyderabad, Telangana State, **2015**.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. AbdulaliSohaila. **"***I Fought For My Life…and Won***."**Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:
1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

16CS O09

BASICSOF ARTIFICIAL INTELLIGENCE
(ELECTIVE – VII)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basic Mathematics.

Course Objectives: The main objectives of this course are:

1. Provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Differentiate between a rudimentary Problem and an AI problem, it's Characteristics and problem-solving Techniques.
2. Compare and contrast the various knowledge representation schemes of AI.
3. Understand and analyze the various reasoning and planning techniques involved in solving AI problems.
4. Understand the different learning techniques.
5. Apply the AI techniques to solve the real-world problems.

UNIT – I:

Introduction: Definition, history, applications. **Problem Solving:** AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate–and–test, Hill Climbing, Constraint Satisfaction.

UNIT – II:

Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification. **Knowledge Representation (Structured):** Declarative representation, Semantic nets, procedural representation, frames.

UNIT – III:

Reasoning: Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory. **Planning:**Components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT – IV:

Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: Decision tree. **Intelligent Agents:** Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - V

Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition. **Perception and Action:** Real Time Search, Vision, Speech Recognition, ACTION: Navigation, Manipulation, Robot architectures.

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, "*Artificial Intelligence*", 3rd Edition, 2008
2. Russell Norvig, "*Artificial Intelligence-Modern Approach*", 3rd edition, 2010.

Suggested Reading:

1. Saroj Kaushik, "*Artificial Intelligence*", Cengage Learning India, 2012.
2. Nelson M. Mattos, " *An Approach to Knowledge Base Management*", Springer Berlin Heidelberg, 1991.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

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16EE O05

WASTE MANAGEMENT
(ELECTIVE – VII)(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To Imbibe the concept of effective utilization of any scrap
2. To Become familiar with the processes of all disciplines of engineering.
3. To Learn the technique of connectivity from waste to utility.

Course outcomes: After completion of this course, students will be able to:

1. Understand the various processes involved in allied disciplines of engineering
2. Infer the regulations of governance in managing the waste
3. Distinguish the nature of waste materials concerned to the particular branch of engineering
4. Explore the ways and means of disposal of waste material
5. Identify the remedies for the disposal of a selected hazardous waste material

UNIT-I:

Introduction to waste management: Relevant Regulations Municipal solid waste (management and handling) rules; hazardous waste (management and handling) rules; biomedical waste handling rules; fly ash rules; recycled plastics usage rules; batteries (management and handling) rules. Municipal Solid Waste Management – Fundamentals Sources; composition; generation rates; collection of waste; separation, transfer and transport of waste; treatment and disposal options.

UNIT-II:

Hazardous Waste Management : Fundamentals Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects, Radioactive Waste Management – Fundamentals Sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options.

UNIT-III:

Environmental Risk Assessment: Defining risk and environmental risk; methods of risk assessment; case studies, Physicochemical Treatment of Solid and Hazardous Waste Chemical treatment processes for MSW (combustion, stabilization and solidification of hazardous wastes); physicochemical processes for hazardous wastes (soil vapor extraction, air stripping, chemical oxidation); ground water contamination and remediation

UNIT-IV:

Biological Treatment: Solid and Hazardous Waste Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation.

UNIT-V:

Landfill design aspects: Landfill design for solid and hazardous wastes; leachate collection and removal; landfill covers; incineration

Text Books:

1. John Pichtel," *Waste Management Practices*", CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D.Buckingham,P.L. and Evans, J.C. "*Hazardous Waste Management*", McGraw Hill International Editions, New York, 1994
3. Richard J. Watts, "*Hazardous Wastes - Sources, Pathways*", Receptors John Wiley and Sons, New York, 1997

Suggested Reading:

1."*Basics of Solid and Hazardous Waste Mgmt* Tech", KantiL.Shah 1999, Prentice Hall.
2. "*Solid and Hazardous Waste Management* ", 2007 by S.C.Bhatia Atlantic Publishers & Dist.

16CE E16

HEALTH MONITORING AND RETROFITTING OF STRUCTURES
(ELECTIVE – VIII)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the students to

1. Understand SHM as a way of monitoring health of a structure using smart materials
2. Learn and apply the various vibration based techniques for monitoring the health of the structure
3. Learn and apply the various capacitive sensing techniques for structures
4. Comprehend the methods of condition assessment of damages in buildings and to learn the different non-destructive evaluation and testing methods
5. Learn about implementation of health monitoring in different types of structures

Course Outcomes: At the end of the course the graduate should be able to

1. Interpret SHM as a way of monitoring the health of a structure using smart materials
2. Select and implement an appropriate vibration based technique for health monitoring of a structure
3. Select and implement an appropriate capacitive sensing technique
4. Perform condition assessment survey of damaged/ existing buildings and to identify possible defects in a concrete structure and suggest necessary repairs
5. Implement various health monitoring techniques for different types of structures for different situations

UNIT – I:

Introduction of Structural Health Monitoring (SHM) : Introduction, definition of structural health monitoring (SHM), basic components of SHM, Passive and Active SHM, Relationship between SHM – NDE(Non- Destructive Evaluation) and NDECS (Non- Destructive Evaluation of Co-operative Structures), materials for sensor design.

UNIT – II:

Vibration based techniques used for structural health monitoring: SHM using vibration based technique – Introduction – Local and global methods – Applications, SHM using fiber optic sensors – Applications, SHM using Low Frequency Electromagnetic Techniques – Introduction – Applications to the NDE /NDT domain & SHM domain.

UNIT – III:

Capacitive Method: Introduction of capacitive methods, the principle, types of capacitive sensing, capacitive probe for cover concrete – Capacitive sensing in bridges (case studies), Applications for external post – tensioned cables.

UNIT – IV:

Conditions Survey, NDE and NDT of Concrete Structures: Definition and objective of condition survey, stages of conditions survey – planning, inspections and testing stages, possible defects in concrete structures, quality control of concrete structures, NDT techniques- rebound hammer, infra-red thermography, ground penetration technique, ultra-sonic pulse velocity test and Windsor probe test, calibration of NDT equipment and safety audit, semi destructive testing – core cutting.

UNIT – V:

Case studies on structures: Historical buildings, Special structures – bridges, dams, tunnels, high rise buildings.

Text Books:

1. Daniel Balageas and Claus–Peter Fritzen, "*Structural Health Monitoring*", published by ISTE Ltd., U.K .2006.
2. V.M. Malhotra, "*In Situ/Non-destructive Testing of Concrete (Publication, Sp-82)",* published by Amer Concrete Inst 1984.

Suggested Reading:

1. Hua- Peng Chen, "*Structural Health monitoring of large engineering structures*", published by Wiley-Blackwell, 2018.
2. "*Guide book on Non-destructive testing of concrete structures*", training course, series no.17, International Atomic Agency, Vienna 2002.
3. Jean-Paul Balayssac and Vincent Garnier, "*Non Destructive evaluation and evaluation o*
   structures", published by ISTE Press – Elsevier, 2017.

16CE E17

GROUND WATER HYDROLOGY
(ELECTIVE - VIII)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: The student should able to understand

1. Basics of groundwater hydrology, familiar with aquifer parameters.
2. Unsteady flow and its flow computation.
3. Exploring groundwater through surface and subsurface methods.
4. Artificial recharge and causes, methods of recharge.
5. Various models in groundwater, quality of groundwater, pollutant transport.

Course outcomes: The student should able to

1. Assess groundwater potential and head.
2. Estimate hydraulic conductivity and storage coefficient for time variant flow.
3. Investigate groundwater availability for a given area.
4. Plan and design artificial recharge.
5. Construct model and analyze groundwater flow.

UNIT- I:
Introduction : Occurrence of groundwater, rock properties effecting groundwater, groundwater basin, ground water in hydraulic cycle, vertical distribution of ground water, Hydrologic balance equation, types of aquifers, unconfined, confined and leaky aquifers. Darcy's law and limitations, compressibility of aquifer, aquifer parameters, specific yield, safe yield, general equation of ground water flow, steady unidirectional flow. Steady radial flow to a well in unconfined and confined aquifers. Steady flow with uniform recharge.

UNIT- II:
Unsteady radial flow to a well: Non equilibrium equation for pumping tests. This method of solution, Cooper Jacob method, Chow's methods of solution.Law of times, well flow near aquifer boundaries, Image well theory, multiple well systems, well losses, pumping and recuperation tests.

UNIT- III:
Geophysical Exploration: Surface investigations, of ground water – electrical resistivity method, seismic refraction method, gravity and magnetic methods, geologic methods, dowsing. Subsurface Investigations – test drilling, resistivity logging, potential logging, Temperature logging, caliper logging, Interpretation of logs and selection of site as a well.

UNIT- IV:
Artificial Recharge of groundwater: Methods of recharge, water spreading, sewage discharge, recharge through pits and shafts, recharge through well, induced recharge.
Sea water intrusion in coastal aquifers, occurrence, Ghyben – Herzberg relation, shape of fresh – salt water interface, Length of the intruded sea water wedge. Prevention and control of sea water intrusion.

UNIT –V:
Modelling techniques: Introduction, porous media, analog, viscous, membrane, thermal, blotting paper models. Numerical modelling and solutions. Finite difference method.
Quality of groundwater: Sources and Pollution of groundwater, groundwater quality criteria, distribution and evaluation of groundwater pollution, pollutant transport and modelling of pollutant transport.

Text Books:

1. D.K. Todd, "*Ground Water Hydrology",* John Wiley & Sons, Inc., USA, 2015
2. H.M. Raghunath, "*Ground Water*", Wiley Eastern Limited, New Delhi, 2007.

Suggested Reading:

1. Bouwer, "*Ground Water Hydrology*", Mc. Graw Hill, Newyork, 2013
2. A. K. Rastogi, "*Numerical Groundwater Hydrology*", Penram International Publishing, Mumbai, 2007.
3. Bear J, "*Hydraulics of Ground Water*", Mc-Graw Hill, Newyork, 2013.

16CE E18

PRE-STRESSED CONCRETE
(ELECTIVE - VIII)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student to

1. The aim of this course is to introduce students to the basic principles about structural behaviour, of pre stressed concrete structures, with reference to IS 1343 code
2. The objective is to equip the students with a thorough understanding of the behaviour and analysis, design of prestressed concrete beam, slab and column.
3. Various time dependent factors, such as cracking, creep and shrinkage of concrete, and prestress losses, are discussed thoroughly.
4. Background to design equations and relevant modern research will also be discussed to provide the students with solid understanding of the topics covered.
5. To provide students with an opportunity to enhance their skills in pre stressed concrete design and applications. The specific implication, to the serviceability and ultimate limit states are covered.

Course outcomes: On successful completion of this course

1. Students will understand the general mechanism of pre stressed concrete members, types of pre stressing, losses in pre stressing, short and long term deflections in P.S.C members.
2. Students will be able to evaluate the behaviour of pre stressed concrete structures,
3. Students will be able to analyze and design of pre stressed concrete structures using serviceability limit states.
4. Student will be able to analyze and design for shear in P.S.C members.
5. Student will be able to analyze the stresses in anchorage zones and design the end anchorages

UNIT- I:

General Principles of Pre Stressed Concrete:

Introduction: Basic concepts – Materials - permissible stresses – Advantages – pre-tensing and post tensing – Pre Stressing by straight Concentric, Eccentric bent and Parabolic Tendons – Different methods of Pre stressing – Hoyer System – Freyssinet system – Magnel – Blaton system – Lee Mecal system – Use of IS 1343 code, concepts of precast and post tensioned elements.

Losses of Pre stress: Losses in P.S.C. members due to elastic shortening – Shrinkage – Creep in Concrete – Relaxation of Steel – Slip in anchorage – Frictional Loss – Computation of losses.

UNIT – II:

Analysis: Analysis of sections for pre stress and flexure. Deflections of P.S.C members: Importance of deflections - factors influencing deflections, short term and long term deflections – IS code requirements for Maximum deflections – Computation of deflection due to pre stressing force – Dead and live loads – Different cases of loading.

UNIT – III:

Design of Section for Flexure: Allowable stresses – Elastic Design and Limit state method of Design of Rectangular – I Section beams for Flexure – Kern of section – Pressure Line – Cable Profile – IS 1343 Codal Provisions – Check for ultimate flexural strength.

Design of Section for Shear and Torsion: Shear and principal stresses – Cracked and uncracked sections – Codal provisions – Ultimate shear resistance – Design of shear reinforcement in beams – Design of torsional reinforcement in beams.

UNIT – IV:

Anchorage Zone stress in post tensioned members: Stress distribution in End block – A analysis by Magnel and Guyon's methods – IS 1343 code provisions – Bursting Tensile force – Design of anchorage zone reinforcement.

UNIT – V:

Continuous beams: Advantage and Disadvantages – Primary and Secondary moment – P and C lines– Liner transformation concordant and Non concordant cable profile - Analysis and Design of Continuous beams.

Floor slabs: Analysis and design of one way slab and two way slab.

Text Books:

1. N. Krishna Raju ,"*Prestressed Concrete*" , Tata Mc Graw Hill,2018
2. G.S. Pandit and S.P. Gupta, "*Prestressed Concrete*", CBS Pub., 2009.

Suggested Reading:

1. Arthur H. Nilson, "*Design of Prestressed Concrete*", John Wiley 1987.
2. T.Y Lin and Burn," *Design of prestressed Concrete*",Wiley India Private Limited, 2010.

16CE C39

SEMINAR

Instruction		3Hours per week
CIE	50 Marks	
Credits	2	

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of Sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

PROFESSOR & HEAD
Department of Civil Engineering
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16CE C40

PROJECT

Instruction		6 Hours per week
CIE	50 Marks	
Semester End Examination	100 Marks	
Credits	6	

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 50)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

20CE C101

STRUCTURAL DYNAMICS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the student

1. To make the student understand the importance of structural dynamics and appreciate its practical applications.
2. To make the student learn the process of formulation of equations of motion and generate their solutions.
3. To make the student well versed with modal analysis and make him to develop the response by mode superposition.
4. To make him learn the methods of practical vibration analysis and also generate response considering the system as continuous systems.
5. To make him conversant with the numerical solutions to find the response of dynamic systems.

Course Outcomes: At the end of the course, student is able to

1. The student gains expertise and confidence to tackle field dynamic problems, especially in the field of earthquake and wind engineering. 2. Gets the ability to model any dynamic system and get its response.
3. Can carry out modal analysis and can easily handle any software and can correctly interpret the results.
4. Can effectively use practical vibration analysis methods and obtain the dynamic parameters.
5. Gets the ability to apply numerical methods to get the dynamic response of the systems.

UNIT - I:

Introduction to structural Dynamics – Source of dynamic forces – Rotating machinery, wind and seismic forces, blast loads. **Methods of discretization**: Lumped mass Procedure and Consistent mass procedure.

Single Degree Freedom Systems – **Formulation of Equation of Motion**: D'Alemberts's Principle, Method of Virtual Work, Hamilton's Principle.

Generalized SDOF systems and Rigid Body assemblage. Influence of Gravity Forces and Ground Motion on equation of motion.

UNIT - II:

Single Degree of Freedom System: Response to Free Vibration with and without Damping, Logarithmic decrement. Response to Harmonic loading and impulsive loading. Dynamic magnification factor, phase angle and band width. Response to General Dynamic loading using Duhamel's Integral - Fourier analysis for Periodic Loading.

UNIT - III:

Multiple Degree of Freedom System: Evaluation of structural property matrices – Formulation of MDOF equations of motion – Undamped free vibration – Solution of Eigen value problem for natural frequencies and mode shapesAnalysis of dynamic response- Normal coordinates – Orthogonal properties of normal modes -Uncoupled equations of motion –- Mode super position procedure.

UNIT - IV:

Practical Vibration Analysis: Stodola Method – Fundamental mode analysis, Analysis for second and higher modes. Holtzer Method – basic procedure. **Continuous Systems:** Flexural vibrations of beams- Elementary case - Derivation of governing differential equation of motion - Analysis of undamped free vibration of beams in flexure – Natural frequencies and mode shapes of simple beams with different end conditions.

UNIT - V:

Numerical Evaluation of Dynamic Response of linear (SDOF/MDOF) systems: Time stepping methods, Central difference method, Newmarks method and Wilson method.

References:

1. Anil. K. Chopra," *Dynamics of Structures",* Pearson Education India, 2007.
2. Ray W. Clough, Joseph Penzin," *Dynamics of Structures*", CBS Publishing, 2015.
3. Mario Paz,"*Structural Dynamics: Theory And Computation*", CBS Publishing, 2004.

4. PankajAgarwal and Manish Shrikhande*," Earthquake Resistant Design of Structures"*, PHI, 2006.
5. Biggs," *Introduction to Structural Dynamics*", Mc Graw Hill Education, 2013.

20CE C102

FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the student

1. Learn the fundamentals of Finite element method (FEM) and derive elasticity matrices for 2-D and 3-D elasticity problems.
2. Understand basic principles of minimum potential energy methods and variational formulation of FEM know the stiffness matrix formulations using bar element and analyze simple problems.
3. Understand the FEM formulation using truss, beam, and plane frame elements and analyze simple problems with kinematic indeterminacy not greater than 3.
4. Get familiarized with displacement models, Isoparametric elements and quadrilateral elements and know the formulation of global stiffness matrices.
5. Know the formulation of stiffness matrices for Axi-Symmetric elements, Tetrahedron elements.

Course Outcomes: At the end of the course, student is able to 1. The fundamentals of FEM, elements of theory of elasticity.

2. Principle of minimum potential energy and variation formulation of FEM and analyze simple problems using bar elements.
3. The analysis of trusses beams and rigid jointed plane frames.
4. The formulation of Global stiffness matrix, load matrix and analysis structures using 1st order triangular elements, isoparametric elements, and quadrilateral elements.
5. Application of Axi-Symmetric and Tetra-Hedron elements.

UNIT - I:

Introduction to FEM: General description of the method, brief history of the method, applications of the method, advantages of the finite element method,

steps in the finite element method. Types of elements; Types of forces, and Boundary conditions.
Strain displacement, and stress- strain relations for 2-D and 3-D problems. Equations of equilibrium and compatibility conditions for 2-D and 3-D problems. Plane stress and plane strain situations and derivation of elasticity matrices (D).

UNIT - II:

Finite Element Formulation: Principle of minimum potential energy, Principle of virtual displacement, Global coordinate system, local coordinate system, Raleigh Ritz method, Weighted Residual method- Galerkin's method, Boundary value problems- with one element and two elements.
Bar Elements: Shape functions, stiffness matrix for a 2- noded bar element, axial bar subjected to point loads-constant cross section and varying cross section bar.

UNIT - III:

Truss Elements: Transformation matrix, Stiffness matrix of truss member in local and global axis, analysis of trusses with kinematic indeterminacy not exceeding three.
Beam Elements: Shape functions, beam element stiffness matrix, element load vector, and analysis of continuous beams with kinematic indeterminacy not exceeding three.
Plane Frame elements: Element stiffness matrix in local coordinates, Transformation or Rotation matrix, and stiffness matrix and load vector in global coordinates.

UNIT - IV:

Displacement models: Selection of displacement models, geometric invariance, conforming and non-conforming elements.
2-D Triangular Elements (CST) and Rectangular Elements: Determination of strain-displacement matrix, shape functions, determination of element stiffness and load matrices, assembling global stiffness and load matrices. Problems with kinematic indeterminacy not exceeding three.
Iso-parametric elements: Iso-parametric concept, Iso-parametric, Sub parametric and Super parametric elements. Gauss Quadrature of numerical integration. **Quadrilateral elements**: Construction of shape functions for 4 noded and 8 noded elements, determination of stiffness matrix, and nodal load matrices for 4noded quadrilateral element.

UNIT - V:

Axi-symmetric elements: Strain-displacement relationship, stress-strain relationship, determination of stiffness matrix for 3-noded ring element and load matrices for body force and surface traction.

Tetrahedron elements: Volume coordinates, Strain-displacement matrix, and stiffness matrix.

Computer Implementation of FEM procedure, Pre-Processing, Post-Processing.

Use of Commercial FEA software.

References:

1. David V. Hutton," *Fundamentals of Finite Element Analysis*", McGraw Hill Education (India) Private Limited, Delhi, 2014.
2. P. N. Godbole," *Introduction to Finite Element Method"*, I. K. International Publishing House Pvt. Ltd. New Delhi, 2013.
3. P. Seshu, "*Finite Element Analysis*", Prentice Hall of India Private Limited, New Delhi, 2010.
4. T. R. Chandrupatla and A. D. Belegundu," *Introduction to Finite Elements in Engineering*", Prentice –Hall of India Private Limited, New Delhi, 2009.
5. Daryl L, Logan, "*A first course in the Finite Element Method*", Third Edition, Thomson Brook, Canada Limited, 2007.
6. R. D. Cook, R.D" *Concepts and Applications of Finite Element Analysis*", John Wiley and sons, 1981.
7. O. C. Zienkiewicz. And R. L. Taylor, "*The Finite Element Method*", Vol.1, McGraw Hill Company Limited, London, 1989.

20CE E102

ADVANCED STRUCTURAL ANALYSIS
(ELECTIVE-I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the student

1. Gain knowledge of using matrix methods of structural analysis stiffness and flexibility methods to analyse beams and trusses
2. Learns the basic concepts of analyse of frames and grids using flexibility methods.
3. Learns the basic concepts of analysis frames and slides using stiffness method
4. Understand the concepts of beams on elastic foundations with semi infinite and infinite lengths
5. Grasps the fundamentals of solving boundary value problems using approximate methods

Course Outcomes: At the end of the course, student will be able to

1. Analyse continuous beams and redundant trusses using force and displacement approaches (flexibility & stiffness approaches) of matrix methods
2. Analyse rigid jointed plane frames and grids by flexibility methods.
3. analyse rigid jointed plane frames and grids by stiffness methods.
4. Applies the concepts of (beams of semi-infinite and infinite lengths) an elastic foundation to field problems and analytical models.
5. Solve the boundary value problems using approximate methods.

UNIT- I:

Introduction to matrix methods of structural analysis: Static and kinematic indeterminacies, Matrix formulations by force and displacement methods, Analysis of continuous beams and redundant trusses by force and displacement methods with degree redundancy and freedom not exceeding three.

UNIT- II:

Analysis of rigid jointed plane frames and grids: by Flexibility approach with degree of redundancy not exceeding three**.**

UNIT- III:

Analysis of rigid jointed plane frames and grids: by Stiffness approach with degree of freedom not exceeding three.

UNIT- IV:

Beams on elastic foundation: Introduction - Modulus of foundation and basic equation - Beams of infinite length under concentrated and uniformly distributed loads - Analysis of semi-infinite beams making use of functions for infinite beams.

UNIT- V:

Boundary Value Problems (BVP): Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.

References:

1. William Weaver and James M. Gere, "*Matrix Analysis Framed Structures* ", CBS, 2004.
2. Devadas Menon," *Advanced Structural Analysis*", Narosa, 2009.
3. A. K. Jain, "*Advanced Structural Analysis*", Nem Chand & Bros. 2015.
4. R. C. Hibbler," *Structural Analysis*", Pearson, 2015.
5. P. Seshu," *Text Book of Finite Element Analysis*", PHI, 2003.

20CE E104

STRUCTURAL HEALTH MONITORING (ELECTIVE-II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the student to understand the fundamental concepts of

1. Distress in the structure.
2. Assess the health of structure. Audit for structural health monitoring
3. Static and dynamic field tests.
4. Repairs, strategies for repairs and rehabilitation methods of the structure
5. Piezo–electric materials and other smart materials,

Course Outcomes: At the end of the course, students will be able to

1. Appraise importance of Diagnosis the distress in the structure, develop an understanding the root causes and factors.
2. Assess the health of structure using static field methods.
3. Assess the health of structure using dynamic field tests.
4. Identify the locations for repairs and various repair methods, can able to suggest rehabilitation methods for structure
5. Adapt and implement EMI technique

UNIT- I:

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

Structural Health Monitoring**:** Concepts, Various Measures, Structural Safety in Alteration.

UNIT- II:

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT- III:

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

UNIT- IV:

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT –V:

Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

References:

1. Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes," *Structural Health Monitoring*", John Wiley and Sons, 2006.
2. Douglas E Adams,"*Health Monitoring of Structural Materials and Component Methods with Applications*", John Wiley and Sons, 2007.
3. J. P. Ou, H. Li and Z. D. Duan,"*Structural Health Monitoring and Intelligent Infrastructure, Vol1"*, Taylor and Francis Group, London, UK, 2006.
4. Victor Giurglutiu," *Structural Health Monitoring with Wafer Active Sensors*", Academic Press Inc, 2007.

20ME M103

RESEARCH METHODOLOGY AND IPR

Instruction	2 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Outcomes: At the end of the course, student will be able to

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT – I:

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT – II:

Literature Survey Report writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing a report. Research Proposal Preparation: Writing a Research Proposal and

Research Report, Writing Research Grant Proposal

UNIT – III:

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT – IV:

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT – V:

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

References:

1. C.R Kothari, "*Research Methodology, Methods & Technique*"; New Age International Publishers, 2004
2. R. Ganesan, "*Research Methodology for Engineers*", MJP Publishers, 2011
3. Y.P. Agarwal, "*Statistical Methods: Concepts, Application and Computation*", Sterling Publs., Pvt., Ltd., New Delhi, 2004.
4. AjitParulekar and Sarita D' Souza, "*Indian Patents Law – Legal & Business Implications*"; Macmillan India ltd , 2006
5. B. L.Wadehra; "*Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications*"; Universal law Publishing Pvt. Ltd., India 2000.

6. P. Narayanan; *"Law of Copyright and Industrial Designs*"; Eastern law House, Delhi 2010

20CE C103

STRUCTURAL DESIGN LAB

Instruction (Practical)	4 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	50 Marks
Credits	2

Course Objectives: **Course Objectives: To enable the student**

1. Learn the principles of idealization of beam grids and frames for the given plan of a building
2. Know the methods of calculating loads on the building elements
3. Grasp the concepts of Analysis of building frames manually & also using software elements
4. Understand the concepts of design of building elements with a practical approach, and also concepts of grouping the designs.
5. Learn the professional practices of preparing structural drawings with good detailing.

Course Outcomes: At the end of the course, student is able to

1. Idealize beam grids and frames for the given plan of a building
2. Calculate loads on building elements for a given plan
3. Analyse building frames using a manual method and software
4. Design all structural elements of a given building with a practical approach and grouping the design.
5. Prepare structural drawings with good detailing, in a professional way.

Design Project:

Design and Detailed drawing of complete G+ 3 structures: Idealization of beam grid and frames for a given plan – Load calculations and preliminary design – Analysis of frames using software, manual check for atleast one frame – Design of building elements using software – grouping of members – design of typical elements (manually) - detailing of reinforcement for various groups of elements – preparation of structural drawings – introduction to processional practices in drawing.

References:

1. V. L. Shah and V. R. Karve, "*Illustrated Design of Reinforced Concrete Buildings (Design of G+3 Storeyed Buildings + Earthquake Analysis & Design)* ", Assorted Editorial; 8th edition (2017).
2. **SP: 34 (1987),"***Handbook on Concrete Reinforcement and Detailing*", Bureau of Indian Standards.
3. **IS: 456 (2000),"***Plain and Reinforced Concrete - Code of Practice*", Bureau of Indian Standards.
4. **SP: 16** (1978),"Design Aids for Reinforced Concrete to IS 456:1978",*Bureau of Indian Standards*.

20CE C104

ADVANCED CONCRETE LAB

Instruction (Practical)	4 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	50 Marks
Credits	2

Course Objectives: To enable the student

1. Understand the stress- strain behavior of high strength concretes
2. Assesses the correlation between cube strength cylindrical strengths, split tensile strength and modulus of rupture of concrete
3. Knows the effect of cyclic loading on steel
4. Grasps the various procedures of conducting non-destructive tests on existing concrete members.
5. Understand the behavior of concrete beams under flexural and shear.
6. Understands the behavior of concrete beams under torsion.

Course Outcomes: At the end of the course, student is able to

1. Deduce the stress - strain values for a given high strength concrete and checks its suitability for a purpose.
2. Interpret the correlation between the cube strength, cylindrical strength split tensile strength And modulus of rupture and determines any missing value among these, others being known.
3. Suggest suitable grade and quantity of steel for resisting cyclic loads.
4. Conduct suitable non-destructive test for the condition assessment of existing concrete members
5. Take proper precaution to avoid flexural and shear failures in concrete beams
6. Strengthen the concrete members to resist torsion.

List of Experiments / Assignments:

1. Study of stress - strain curve of high strength concrete
2. Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
3. Effect of cyclic loading on steel.
4. Non-Destructive testing of existing concrete members.

5. Behavior of Beams under flexure, Shear
6. Torsion

References:

1. A. M. Neville," *Properties of concrete*", 5th Edition, Prentice Hall, 2012
2. M. S. Shetty, "Concrete *technology"*, S. Chand and Co., 2006.

20CE C105

DESIGN OF HIGH-RISE STRUCTURES

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

To make the student learn**:**

1. the differences between the regular buildings and tall buildings
2. various structural systems usually considered for the functional design of the tall buildings
3. various methods of calculation lateral forces (both wind forces and seismic/ earth quake forces) on the tall buildings
4. the provisions of relevant IS codes (IS:875 - Part-3, IS:1893 - Part-1) in calculating the lateral forces mentioned above, on tall buildings
5. the importance of ductility of various structural members in resisting the seismic loads on tall buildings and the relevant provisions of the IS code (IS: 13920) regarding the reinforcement detailing in achieving this ductility in RCC members.
6. the concept of performance based design in resisting seismic forces on tall buildings

Course Outcomes:

The students can

1. Understand the loads acting on the tall buildings.
2. Learn the concept of analysis of high rise building for wind loads
3. Learn the concept of analysis of high rise building for seismic loads
4. Learn the different structural systems for high rise buildings
5. Learn the assessment of nonlinear performance of the structures

Course Syllabus:

UNIT-I

Introduction:

Importance of Lateral Loads for high rise buildings, types of foundations for tall buildings. Second order effects of gravity loading, Creep and shrinkage in columns, Differential shortening of columns, Floor levelling problems, Panel zone effects, P-Delta effects

UNIT-II

Wind Loads:

Introduction to wind loads, characteristics of wind, Computation of wind loads on buildings as per IS code, Principles of analysis, Introduction to Computational Fluid Dynamics, Wind Tunnel testing.

UNIT-III

Seismic Loads:

Introduction to Earthquakes, Characteristics of Earthquake, Computation of seismic loads on tall buildings – Equivalent static load method, Response Spectrum Method. Vibration Control – active control & passive control. Liquefaction effects, Introduction to Time history Analysis

UNIT – IV

Structural systems:

Necessity of special structural systems for tall buildings, Structural Systems for **Steel Buildings -** Braced frames, Staggered Truss System, Eccentric Bracing System, Outtrigger & Belt truss system, Tube Systems**;** Structural Systems for **Concrete Buildings -** shear walls, frame tube structures, bundled tube structures**;** Design of shear wall as per IS code

UNIT- V

Performance Based Design: Behavior of reinforced concrete members in bending - moment curvature relationship; Plastic hinge, Factors affecting rotation capacity of a section, Plastic moment - Redistribution of moments. Pushover Analysis

Suggested Reading:

1. Taranath B. S., "*Structural Analysis and Design of Tall Buildings*", McGraw-Hill Book Company, 1988.
2. Simlu E, "*Wind Effect on Structures: An Introduction to Wind Engineering*", Wile and Sons, 1978.
3. Fintel, M, "*Hand Book of Concrete Engineering*", Von Nostrand, 1974.
4. Emilio Rosenblueth, "*Design of Earthquake Resistant Structures*", Pentech Press Ltd., 1990.
5. Schuellar, W, "*High Rise Building Structures*" , John Wiley & Sons Inc, 1977.
6. Bryan Stafford Smith & Alex Coull, "*Tall Building Structures: Analysis & Design*", Wiley India Pvt Ltd, 1991.
7. Lynn S. Beedle, "*Advances in Tall Buildings*", CBS Publishers and Distributors Delhi, 1996.

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20CE C106

ADVANCED SOLID MECHANICS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks

Course objectives: To enable the student

1. To make the students understand the concepts of elasticity and equip them with the knowledge to independently handle the problems of elasticity.
2. To enhance the competency level and develop the self-confidence through quality assignments in theory of Elasticity and plasticity.
3. To inculcate the habit of researching and practicing in the field of elasticity and plasticity.

Course Out Comes: The students

1. Will be able to solve the problems of 3-D elasticity with confidence.
2. Can independently work with the problems of 2-D elasticity in Cartesian/Polar Coordinates.
3. Are familiarized with the use of Airy's stress function in 2-D problems of elasticity in Cartesian/Polar Coordinates.
4. Are equipped with the knowledge of various theories of torsion of prismatic bars of various cross sections and can solve the problems of torsion.
5. Will be able to solve plasticity problems in Structural engineering

UNIT- I:

Definition of stress and strain: Notation of stresses in three dimensions – Generalized Hooks law.

General Theorems: Differential equations of equilibrium in 3-D - Equations of Equilibrium in terms of displacements – Boundary Conditions - conditions of compatibility - Transformation of stress components under change of co-ordinate system.

UNIT- II:

Plane stress and plane strain: differential equations of equilibrium - boundary conditions - compatibility equations

Stresses on an oblique plane – Stress Invariants - principal stresses - stress ellipsoid - max shear stresses - Octahedral shear stress – Strain energy per unit volume - Strain of a line element - principal strains.

UNIT- III:

Two dimensional problems in rectangular coordinates: Stress function Applications - solution by polynomials - Saint- Venant's principle - determination of displacements - bending of simple beams - gravity loading.

Two dimensional problems in polar coordinates: Airy's stress function - general solution of two- dimensional problem in polar coordinates - stress distribution symmetrical about an axis – Effect of hole on stress distribution in a plate in tension, Stresses in a circular disc under diametrical loading - strain components in polar coordinates

UNIT- IV:

Torsion of Prismatic Bars: torsion of prismatic bars - bars with elliptical cross sections – other elementary solution - membrane analogy - torsion of rectangular bars - solution of torsion problems by energy method - use of soap films in solving torsion problems

UNIT- V:

Theory of Plasticity: Introduction – Idealized Stress-Strain curve, concepts and assumptions - yield criterions – Von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-strain relations- Principle of Normality and plastic potential.

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References:

1. Timoshenko S. and Goodier, "*Theory of Elasticity*", Mc Graw hill Publications, 2015.
2. J.Chakraborty,"*Theory of Plasticity*", Mc Graw hill Publications, 2007.
3. S. Singh, "*Theory of Elasticity*", Khanna Publishers, 2003

20CE E107

REPAIR AND RETROFITTING OF STRUCTURE
(ELECTIVE-III)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the student

1. Gain knowledge of Distress and reasons for distress in concrete
2. Learns the basic concepts of serviceability and durability, corrosion etc.
3. Understand the concepts of different repair materials and their suitability
4. Understand the fundamental principles of retrofitting and rehabilitation
5. Learns the basic concepts of Structural health monitoring.

Course Outcomes: At the end of the course, student is able to

1. Identify reasons for distress and suggest remedial measures
2. Analyze the causes for corrosion and identify the durability factors for the safety of structures
3. Identify and suggest various repair materials
4. Analyze and suggest the retrofitting methods
5. Identify the suitable Tests required for SHM

UNIT - I

Maintenance: Repair and rehabilitation - Facets of maintenance - Importance of maintenance various aspects of inspection – Assessment procedure for evaluating damaged structure - Causes of deterioration. Repair Strategies: Causes of distress in concrete structures – Construction and design failures - Condition assessment and distress-diagnostic techniques - Assessment procedure for inspection and evaluating a damaged structure.

UNIT - II

Serviceability and durability of concrete: Quality assurance for concrete construction - Concrete properties – Strength - Permeability – Thermal properties and cracking. – Effects due to climate - Temperature - Chemicals - Corrosion – Design and construction errors – Effects of cover thickness and cracking.

UNIT - III

Materials and techniques for repair: Special concretes and mortar - Concrete chemicals - Special elements for accelerated strength gain - Expansive cement - Polymer concrete - Sulphur infiltrated concrete - Ferro cement - Fibre reinforced concrete - Bacterial concrete – Rust eliminators and polymers coating for rebars during repair – Foamed concrete - Mortar and dry pack – Vacuum concrete - Gunite and shotcrete

- Epoxy injection - Mortar repair for cracks - Shoring and underpinning -Methods of corrosion protection - Corrosion inhibitors – Corrosion resistant steels - Coating and cathodic protection.

UNIT - IV

Repair, rehabilitation and retrofitting techniques: Repairs to overcome low member strength - Deflection - Cracking - Chemical disruption - Weathering corrosion - Wear - Fire - Leakage and marine exposure - Repair of structure – Common types of repairs – Repair in concrete structures – Repairs in under water structures – Guniting – Shot create –Underpinning - Strengthening of structures – Strengthening methods – Retrofitting – Jacketing.

UNIT – V

Health monitoring and demolition techniques: Long term health monitoring techniques - Engineered demolition techniques for dilapidated structures - Use of sensors – Building instrumentation.

Suggested Reading:

1. Barry A. Richardson, “Defects and Deterioration in Buildings”, E & FN Spon Press, London, 1991.

2. J. H. Bungey, “Testing of Concrete in Structures”, Chapman and Hall, New York, 1989.
3. A.R. Santakumar, “Concrete Technology”, Oxford University Press, New Delhi, 2006.
4. B.L. Gupta and Amit Gupta, ‘Maintenance and Repair of Civil Structures”, Standard Publications, New Delhi, 2010.
5. Peter H. Emmons, “Concrete Repair and Maintenance Illustrated”, RS Means, John Wiley & Sons, New York, 1981.
6. W.H. Ransom, “Building Failures: Diagnosis and Avoidance”, E & FN Spon Press, London, 1992.
7. P.K. Mehta and P.J.M. Monteiro, “Concrete - Microstructure, Properties and Materials”, McGraw-Hill, New York, 2014.
8. N. Jackson and R.K, Dhir, “Civil Engineering Materials”, Basingstoke, Macmillan, London, 1988.

20CE E109

DESIGN OF ADVANCED CONCRETE STRUCTURES
(ELECTIVE-IV)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

Course objectives: To enable the student

1. To make the students effectively analyse and design Curved and Deep Beams.
2. To enable the students understand the nuances of internal stresses and design of Domes, and thoroughly learn the analysis and design procedures for bunkers and silos.
3. To make the student attain the detailed knowledge to understand the performance of flat slabs and design them by both DDM and EFM.
4. To make the students understand the structural behaviour Raft, Pile and Machine foundations and be able to design them.
5. To make them understand and appreciate the importance of ductile detailing. The student should also be able to design solid shear walls.

Course out Comes: Upon the completion of this course, the student should be able to

1. Analyse and Design curved and deep beam as per the field requirements.
2. be able to find the stresses in domes for various loads and design them.
3. With the thorough knowledge acquired during the course, the student is able to analyzeand design Bunkers and Silos with ease.
4. be able to assess the structural behaviour of Raft, Pile and Machine foundations and design them.
5. Gets reasonable expertise to implement ductile detailing and also design solid shear walls.

UNIT – I:

Beams curved in plan: Introduction – Design Principles – Structural Design of beams circular and semi-circular in plan, continuously and symmetrically supported, rectangular in cross-section.

Deep Beams: Introduction – flexural and shear stresses in deep beams. – I.S. Code provisions – design of simply supported and continuous Deep beams.

UNIT - II:

Domes: Introduction - Stresses and forces in domes - design of spherical and conical domes.

Bunkers and Silos: Introduction - Design principles and theories - IS Code provision - design of rectangular bunkers - design of cylindrical soils.

UNIT – III:

Flat Slabs: Introduction, components, IS code provisions, Design Methods, design for flexure and shear

UNIT – IV:

Pile foundations: Structural design of piles and pile caps.

Raft Foundations: Definitions, Types – Design of Raft foundation, flat plate type and beam-slab type for buildings with column grids up to five by five.

UNIT - V:

Ductile Detailing: Ductile detailing of RCC beams and columns using IS: 13920 -1993 code

Design of Shear Walls: Design and Detailing of Shear Walls considering shear wall-frame interaction in a tall RC structure subjected to seismic loading.

References:

1. N.KrishnaRaju," *Advanced Reinforced Concrete Design*", CBS Publishers, 2005.
2. H.J. Shah, "*Reinforced Concrete*", Charotar Publishers, 2014.
3. P.C.Varghese, "*Advanced Reinforced Concrete Design*", PHI, 2005
4. B.C.Punmia, Ashok Kumar Jain," *Comprehensive R.C.C. Designs*", Laxmi Pub. 2005.

20CE A101

DISASTER MITIGATION AND MANAGEMENT

(Audit Course I and II - Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	Pass/Fail

Course Objectives: To enable the student

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course Outcomes: At the end of the course the student

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. To understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same

5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

UNIT- I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and manmade; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority
(NDMA).

UNIT- II:

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT- III:

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multistoreyed buildings.

UNIT- IV: Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT- V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental responsewater, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

References:

1. Pradeep Sahni*," Disaster Risk Reduction in South Asia*", Prentice Hall, 2003.
2. B. K. Singh,*" Handbook of Disaster Management*: *techniques & Guidelines*", Rajat Publication, 2008.
3. Ministry of Home Affairs". *Government of India, "National disaster management plan, Part I and II",*
4. K. K. Ghosh," *Disaster Management",* APH Publishing Corporation, 2006.
5. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
6. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
7. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

20CE C107

MODEL TESTING LAB

Instruction (Practical)	4 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	50 Marks
Credits	2

Course Objectives: To enable the student to

1. Learn to estimate natural frequencies and mode shapes of a beam.
2. Understand the evaluation process of dynamic response of a building model using shake table / mini shake table
3. Learn to compute the response of building models to wind loads, using wind tunnel set up.
4. Know the pattern of deflection and cracking in RC slab elements and portal frames under gravity loading.
5. Understands the use of Piezo electric sensors in the determination of vibration characteristics of a beam

Course Outcomes: At the end of the course, student is able to 1. Estimate the natural frequencies and mode shapes of a beam.

2. Evaluate the dynamic response of a building model using shake table / mini shake table set up.
3. Evaluate the response of building models under wind loads, using wind tunnel setup.
4. Determine the pattern of deflection and cracks in RC slab elements and portal frames, under static loading.
5. Use Piezoelectric sensor for the determination of vibration characteristics of a beam.

List of Experiments:

1. Estimation of natural frequencies and mode shapes of a beam.
2. Evaluation of dynamic response of building model using shake table set up.
3. Evaluation of response of building models subjected to wind loads using wind tunnel set up.
4. Deflections and crack pattern study of RC slab elements subjected to static loading.

5. Deflections and crack patterns in portal frame subjected to gravity loading.
6. Demonstration of use of Piezoelectric Sensors for the determination of Vibration Characteristics of a beam

20CE C108

NUMERICAL ANALYSIS LAB

Instruction (Practical)	4 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	50 Marks
Credits	2

Course Objectives: To enable the student

1. Find Roots of non-linear equations by Bisection method and Newton's method.
2. Do curve fitting by least square approximations
3. Solve the system of Linear Equations using Gauss - Elimination/ Gauss
   - Seidal Iteration/ Gauss - Jordan Method
4. To Integrate Numerically Using Trapezoidal and Simpson's Rules
5. To Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge- Kutta Method.
6. Apply computational methods in engineering using MAT Lab program

Course Outcomes: At the end of the course, student is able to

1. To find roots of non linear equations by using numerical methods
2. To know how to fit the given data in different curves
3. To know how to solve system of linear equations by using direct and indirect methods
4. To know how to integrate by using numerical methods
5. To find solution of first order ODE by numerical methods
6. To know how to apply computational methods in engineering by using MAT Lab program

List of Programmes

1. Find the Roots of Non-Linear Equation Using Bisection Method.
2. Find the Roots of Non-Linear Equation Using Newton's Method.
3. Curve Fitting by Least Square Approximations.
4. Solve the System of Linear Equations Using Gauss - Elimination Method.

5. Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.
6. Solve the System of Linear Equations Using Gauss - Jordan Method.
7. Integrate numerically using Trapezoidal Rule.
8. Integrate numerically using Simpson's Rules.
9. Numerical Solution of Ordinary Differential Equations by Euler's Method.
10. Numerical Solution of Ordinary Differential Equations by RungeKutta Method.

References:

1. RudraPratap," *Getting started with MATLAB: A quick Introduction for Scientists and Engineers*", Oxford University press, 2010.
2. Grewal B. S," *Numerical Methods in Engineering and Science with Programs in C, C++ & MATLAB*", Khanna Publishers 2014.
3. Dukkipati Rao V, "*Applied Numerical Methods using MATLAB"*, New Age International Pvt. Ltd. Publishers, 2011.

20CE C109

MINI PROJECT WITH SEMINAR

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Outcomes: Students are able to

1. Formulate a specific problem and give solution.
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions.
4. Conclude the results obtained.
5. Write the documentation in standard format.

Guidelines:

- As part of the curriculum in the II- semester of the programme each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
- Each student will be allotted to a faculty supervisor for mentoring.
- Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
- Mini projects shall have inter disciplinary/ industry relevance.
- The students can select a mathematical modelling based/Experimental investigations or Numerical modeling.
- All the investigations are clearly stated and documented with the reasons/explanations.
- The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and references.

Department committee: Supervisor and two faculty coordinators

Guidelines for awarding marks (CIE): Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	20	Progress and Review
	05	Report

Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

20CE E115

DESIGN OF BRIDGES
(ELECTIVE-V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To impart the knowledge in various design principles of Bridge Engineering,

1. The student should be able to design simple bridges individually and be effective contributor in design groups while working on large projects.
2. To make the student conversant with the latest developments in the field of bridge engineering.
3. The student should have a fair familiarity with Indian codes and codes of other countries.

Course Outcomes:

1. Attains ability to design slab and T beam bridges and gets well versed with lateral load distribution for T girders.
2. Acquires sound knowledge about various structural actions of box girder bridges . He also gets the ability to analyse box girders
3. Using some approximate methods and design single cell box girder bridges.
4. Gets thorough knowledge in Railway loadings and can design both Plate girder and Truss girder bridges with ease and efficiency.
5. The student gets comprehensive idea about long span flexible bridges and the problems associated with them. He gets to know the
6. Wind effects and the importance of aerodynamic stability. He also will be able to design elastomeric bearings for bridges.
7. The student gets a clear understanding of bridge foundations and also acquires knowledge about various construction techniques.

UNIT – I:

Introduction: Types of bridges – Materials of construction, Planning and layout, Hydraulic design, Provisions of IRC-6 and IRC-21, Design of slab bridges, Design of T-girder bridges, Lateral load distribution in T-beam slab bridges – Courbon’s method, Guyon Massenet method – Design of slabs subjected to concentration loads using Pigeaud’s curves.

UNIT – II:

Box girder bridges – various structural actions, Methods of analysis, Beams on elastic foundation method, grillage method and space frame analysis, Shear lag and Edge stiffing effects – Provisions of IRC-18 and IRC-21, Design of simply supported single cell PSC box girder bridge.

UNIT – III:

Steel bridges and composite bridges - Bridge rules and Bridge code of RDSO, Truss girder steel railway bridges – Design of stringer beams, cross girders and truss system, Wind load effects Design of composite bridges as per IRC-22

UNIT – IV:

Long span flexible bridges – suspension bridges and cable stayed bridges – stiffening girders and stress, towers, cables – Importance of wind and aerodynamic stability. Bearings – Types of bearing, Design of elastomeric bearings

UNIT – V:

Sub structure – Piers and towers – Types of forces, Stability analysis of solid type piers, Types of bridge foundations and their design principles, Construction techniques – Cast in-situ, Prefabricated, Incremental launching and Free cantilever construction techniques.

References:

1. Wai-Fah Chen LianDuan , “*Bridge Engineering Handbook*”,, CRC Press, USA, 2000
2. R. M. Barker and J. A. Puckett, John Wiley & Sons, “*Design of Highway Bridges*”, New York, 1997
3. P. P. Xanthakos, John Wiley & Sons, “*Theory and Design of Bridges*”, New York, 1994
4. Raja Gopalan, “*Bridge Superstructure”* – Narosa Publishing – 2010.
5. N. KrishnamRaju, “*Design of Bridges”* Oxford and IBH Publishing – 2010.
6. Johnson Victor, “*Essentials of Bridge Engineering*”, Oxford & IBH Publishers, Sixth edition 2018.

20CS O101

BUSINESS ANALYTICS (OPEN ELECTIVE – Common to All Branches)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The main objectives of this course are to

1. Understanding the basic concepts of business analytics and applications
2. Study various business analytics methods including predictive, prescriptive and prescriptive analytics
3. Prepare the students to model business data using various data mining, decision making methods

Course Outcomes: After completion of the course, students will be able

1. To understand the basic concepts of business analytics
2. Identify the application of business analytics and use tools to analyze business data
3. Become familiar with various metrics, measures used in business analytics
4. Illustrate various descriptive, predictive and prescriptive methods and techniques
5. Model the business data using various business analytical methods and techniques

Unit-I:

Introduction to Business Analytics: Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

Unit-II:

Descriptive Analytics: Introduction, data types and scales, types of measurement scales, population and samples, measures of central tendency, percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization

Unit-III:

Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil's coefficient

Unit-IV:

Decision Trees: CHAID, Classification and Regression tree, splitting criteria, Ensemble and method and random forest. **Clustering**: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, **Prescriptive Analytics**- Linear Programming(LP) and LP model building,

Unit-V:

Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process, cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox

References:

1. U Dinesh Kumar, "*Data Analytics*", Wiley Publications, 1st Edition, 2017
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "*Business analytics Principles, Concepts, and Applications with SAS*", Associate Publishers, 2015
3. S. Christian Albright, Wayne L. Winston, "*Business Analytics - Data Analysis and Decision Making*", 5th Edition, Cengage, 2015

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview
2. https://nptel.ac.in/courses/110105089/

20EE O101

WASTE TO ENERGY (OPEN ELECTIVE – Common to All Branches)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

Course objectives: To make the students to

1. To know the various forms of waste
2. To understand the processes of Biomass Pyrolysis.
3. To learn the technique of Biomass Combustion.

Course outcomes: After completion of this course, students will be able to:

1. Understand the concept of conservation of waste
2. Identify the different forms of wastage
3. Chose the best way for conservation to produce energy from waste
4. Explore the ways and means of combustion of biomass
5. Develop a healthy environment for the mankind

UNIT-I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes Thermo chemical conversion - Direct combustion - biomass gasification pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Desai, Ashok V.," *Non-Conventional Energy"*, Wiley Eastern Ltd., 1990.
2. Khandelwal, K. C. andMahdi, S. S., *Biogas Technology - A Practical Hand Book",* Vol.I &II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Challal, D. S, "*Food, Feed and Fuel from Biomass"*, IBH Publishing Co. Pvt. Ltd., 1991.
4. C. Y. WereKo-Brobby and E. B. Hagan," *Biomass Conversion and Technology*", John Wiley & Sons, 1996.

19CE E114

DESIGN OF PRE-STRESSED CONCRETE STRUCTURES (ELECTIVE-V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student to understand the basics of

1. Elements of prestressed concrete and systems of prestressing
2. Various Losses and their estimation in pre stressed concrete
3. Analysis and design of section for flexure and shear
4. Analysis and transfer of pre stress through end blocks
5. Analyze pre stressed slab and Partial pre stressing – principles

Course Outcomes: At the end of the course, student is able to

1. Understand the basic aspects of pre stressed concrete fundamentals, and calculate losses in the pre stressed concrete.
2. Analyse and design pre stressed concrete beam/girders.
3. Design pre stressed concrete end blocks and understand the mechanism of anchorage zones.
4. Analyse and Design continuous prestressed beams members.
5. Analyse and design slabs with partial and full pre stressing, and also analyse the crack formations rationally

UNIT–I:

Introduction to pre stressed concrete: types of pre stressing, systems and devices, materials, losses in pre stressed. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, code provisions.

UNIT–II:

Statically determinate PSC beams: design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion, code provisions.

UNIT–III:

Transmission of Prestress in Pretensioned members; Anchorage zone stresses for post tensioned members.

UNIT–IV:

Statically indeterminate structures - Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordancy.

UNIT–V:

Composite construction: with precast PSC beams and cast in-situ RC slab - Analysis and design, creep and shrinkage effects. Partial pre stressing - principles, analysis and design concepts, crack- width calculations

References:

1. T. Y. Lin, "*Design of Prestressed Concrete Structures*", Asia Publishing House,2010.
2. N. Krishnaraju, "*Prestressed Concrete",* Tata McGraw Hill, New Delhi,2018.
3. Y. Guyan, "*Limit State Design of Pre stressed Concrete*",., Applied Science Publishers,1972.
4. IS: 1343- Code of Practice for Prestressed Concrete
5. IRC:112

19EE O101

WASTE TO ENERGY
(OPEN ELECTIVE – Common to All Branches)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To make the students to

1. To know the various forms of waste
2. To understand the processes of Biomass Pyrolysis.
3. To learn the technique of Biomass Combustion.

Course outcomes: After completion of this course, students will be able to:

1. Understand the concept of conservation of waste
2. Identify the different forms of wastage
3. Chose the best way for conservation to produce energy from waste
4. Explore the ways and means of combustion of biomass
5. Develop a healthy environment for the mankind

UNIT-I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

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1. Desai, Ashok V.," *Non-Conventional Energy"*, Wiley Eastern Ltd., 1990.
2. Khandelwal, K. C. andMahdi, S. S., *Biogas Technology - A Practical Hand Book",* Vol.I &II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Challal, D. S, "*Food, Feed and Fuel from Biomass"*, IBH Publishing Co. Pvt. Ltd., 1991.
4. C. Y. WereKo-Brobby and E. B. Hagan," *Biomass Conversion and Technology*", John Wiley & Sons, 1996.

19CE C110

DISSERTATION PHASE-I

Instruction	20 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	100 Marks
Credits	10

Course Outcomes: At the end of the course:

1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, national/ international refereed Journals and contact resource persons for the selected topic of research.
3. Students will learn to write technical reports.
4. Students will develop oral and written communication skills to present.
5. Student will defend their work in front of technically qualified audience.

Guidelines:

- The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.
- Seminar should be based on the area in which the candidate has undertaken the dissertation work.
- The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.
- The preliminary results (if available) of the problem may also be discussed in the report.
- The work has to be presented in front of the committee consists of Head, Chairperson-BoS, Supervisor and Project coordinator.
- The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

Guidelines for the award of Marks:	Max. Marks: 100	
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

Note: Department committee has to assess the progress of the student for every two weeks.