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 2017 - 18 from S. No. 4561 – 5171

S.No	Course Name	Code
4561	Engineering Mathematics-I	16MTC01
4562	Engineering Physics	16PYC01
4563	Applied Chemistry	16CYC02
4564	Elements of electrical engineering	16EEC01
4565	Engineering Mechanics	16CEC01
4566	Professional communication in English	16EGC01
4567	Environmental Studies	16CEC01
4568	Engineering Graphics	16MEC02
4569	Engineering Physics laboratory	16PYC03
4570	Applied chemistry laboratory	16CYC04
4571	Professional communication laboratory	16CYC02
4572	Engineering Mathematics-II	16MTC02
4573	Engineering chemistry	16CYC01
4574	Applied Physics	16PYC02
4575	Programming and problem solving	16CSC01
4576	Elements of Mechanical Engineering	16MEC01
4577	Elements of Electronics and communication Engineering	16ECC01
4578	Professional ethics and Human values	16CEC03
4579	Programming laboratory	16CSC02
4580	Mechanical and IT workshop	16MEC03
4581	Applied physics laboratory	16PYC04
4582	Engineering chemistry laboratory	16CYC03
4583	Engineering Mathematics-III	16MTC05
4584	Data Structures	16CSC03
4585	Object oriented programming using java	16CSC04
4586	Logic and switching theory	16CSC05
4587	Discrete Structures	16CSC06
4588	soft skills lab	17EGCO3
4589	MiniProject-1	16CSC09
4590	Data structues lab	16CSC09

4591	Object oriented programming using java lab	16CSC07
4592	Miniproject-1	16CSC08
4593	DataBase Management Systems	16CSC10
4594	Web Technologies	16CSC11
4595	Computer Architecture and Microprocessors	16CSC12
4596	Probability and statistics using R	16CSC13
4597	Linux Programming and Scripting languages	16CSE01
4598	Principles of programming languages	16CSE02
4599	Shell Scripting	16CSE03
4600	Engineering economics and accountancy	16MBC01
4601	Database Management Systems lab	16CSC14
4602	Web technologies lab	16CSC15
4603	Computer Architecture and Microprocessor lab	16CSC16
4604	Automata languages and computation	CS311
4605	Design and Analysis of Algorithms	CS312
4606	Embedded Systems	CS313
4607	Database Management systems	CS314
4608	Operating Systems	CS315
4609	Human values and professional ethics	CE444
4610	Embedded Systems lab	CS316
4611	Database Management Systems lab	CS317
4612	Operating systems lab	CS318
4613	soft skills and employability enhancement	EG221
4614	Compiler Construction	CS321
4615	Software Engineering	CS322
4616	web Technologies	CS323
4617	Computer Networks	CS324
4618	Information storage Management	CS351
4619	Image Processing	CS352
4620	Advanced computer Architecture	CS353
4621	Simulation and Modeling	CS354
4622	Realtime Systems	CS355
4623	Image Processing	CS356
4624	Web Technologies Lab	CS326
4625	Cloud computing lab	CS327
4626	Computer networks lab	CS328
4627	Artificial Intelligence	CS411
4628	Distributed Computing	CS412
4629	Data Mining	CS413
4630	Object oriented system development	CS414
4631	Mobile Computing	CS461
4632	Adhoc sensor networks	CS462
4633	Optimization Techniques	CS463
4634	Open source Technologies	CS464
4635	Software project Management	CS465
4636	Entrepreneurship	ME464
4637	Data Mining lab	CS415

4638	object oriented system development	CS416
4639	project seminars	CS417
4640	Information and network security	CS421
4641	Data science and Big data Analytics	CS471
4642	Cloud computing	CS472
4643	semantic web and social networks	CS473
4644	Cyber forensics	CS474
4645	Human Machine Interaction	CS475
4646	Software Reuse Techniques	CS476
4647	Pattern Recognition	CS481
4648	Bio Informatics	CS482
4649	Machine Learning	CS483
4650	Business Intelligence	CS484
4651	Intellectual Property Rights	ME472
4652	Disaster Mitigation and Management	CE422
4653	Information and network security lab	CS422
4654	Seminar	CS423
4655	Project	CS424
4656	Advanced Algorithms	16CSC101
4657	Advanced Operating Systems	16CSC102
4658	Advanced Databases	16CSC103
4659	Data Mining	16CSE11X
4660	Internet of Things	16CSE12X
4661	Software Quality Assurance & Testing	16CSE13X
4662	ADB Lab (Lab-I)	16CSC104
4663	Seminar - I	16CSC105
4664	Soft Skills Lab	16EG104
4665	Advance Network Technologies	16CSC201
4666	Big Data Analytics	16CSC202
4667	Advanced Software Engineering	16CSC203
4668	Cloud Computing	16CSE251
4669	Image Processing	16CSE243
4670	Streaming Technologies	16CSE263
4671	Big Data Analytics Lab	16CSC204
4672	Seminars-ii	16CSC205
4673	Mini Projects	16CSC206
4674	Project Seminar	16CSC301
4675	Project Work and Dissertation	16CSC401
4676	Engineering Physics Laboratory	16PY C03
4677	Applied Chemistry Laboratory	16CY C04
4678	Engineering Mathematics-I	16MT C01
4679	Engineering Physics	16PY C01
4680	Applied Chemistry	16CY C02
4681	Environmental Studies	16CE C02
4682	Professional Communication in English	16EG C01
4683	Professional Communication Laboratory	16EG C02
4684	Elements of Electrical Engineering	16EC C01

4685	Engineering Graphics	16ME C02
4686	Engineering Mechanics	16CE C01
4687	Engineering Mathematics-II	16MT C02
4688	Engineering Chemistry	16CY C01
4689	Applied Physics	16PY C02
4690	Applied Physics Laboratory	16PY C03
4691	Engineering Chemistry Laboratory	16CY C04
4692	Professional Ethics and Human Values	16CE C03
4693	Programming and Problem solving	16CS C01
4694	Elements of Mechanical Engineering	16ME C01
4695	Elements of Electronics and Communication Engineering	16EC C01
4696	Programming Laboratory	16CS C02
4697	Mechanical and IT Workshop	16ME C03
4698	Engineering Mathematics-III	16MT C05
4699	Discrete Structures and Applications	16IT C01
4700	Data Structures and Algorithms	16IT C02
4701	Object Oriented Programming	16IT C03
4702	Digital Electronics and Logic Design	16IT C04
4703	Data Structures and Algorithms Lab	16IT C05
4704	Object Oriented Programming Lab	16IT C06
4705	Mini Project - I	16IT C07
4706	Soft Skills and Employability Enhancement Lab	16EGC03
4707	Design and Analysis of Algorithms	16IT C08
4708	Data Communications	16IT C09
4709	Java Programming	16IT C10
4710	Computer Organization and Microprocessors	16IT C11
4711	Fundamentals of Data science	16IT C12
4712	Engineering Economics and Accountancy	16MBC01
4713	Java Programming Lab	16IT C13
4714	Micro Processors Lab	16IT C14
4715	Mini Project– II	16IT C15
4716	Principles of Operating Systems	IT 311
4717	Database Systems	IT 312
4718	Compiler Design	IT 313
4719	Information Security	IT 314
4720	Object Oriented System Development using UML	EC 315
4721	Operating Systems Lab	IT 316
4722	Database Lab	IT 317
4723	Human Values and Professional Ethics	CE 144
4724	Soft Skills and Employability Enhancement	EG 221
4725	Mini Project– II	IT318
4726	Computer Networks and Socket Programming	IT 321
4727	Data Warehousing and Data Mining	IT 322
4728	Web Programming	IT 323
4729	Computational Intelligence	IT 324
4730	Digital Image Processing and Analysis	EC 325
4731	Elective-I Natural Language Processing	IT354

4732	Elective –I Software Testing	IT 352
4733	Network Programming Lab	IT 326
4734	Data Mining Lab	IT 327
4735	Mini Project– IV	IT 328
4736	Big Data Analytics	IT 411
4737	Mobile Computing	IT 412
4738	Distributed Systems	IT 413
4739	VLSI Technology	IT 414
4740	Elective –II Diaster mitigation and management	CE422
4741	Elective-II Parallel computing	IT465
4742	Big Data Analytics Lab	IT 415
4743	VLSI Technology Lab	IT 416
4744	project seminar	IT 417
4745	Embedded Systems & Internet of Things	IT 421
4746	Embedded Systems & IoT Lab	IT 422
4747	Elective-III* E-Commerce	IT 476
4748	Elective-IV ** entrepreneurship	ME 464
4749	Project	IT 901
4750	Seminar	IT 423
4751	Number Theory	16ITC101
4752	Advanced Computer Networks	16ITC102
4753	Cryptography and Network Security	16ITC103
4754	Distributed Systems	16ITE111
4755	Machine Learning	16ITE122
4756	Data Hiding	16ITE132
4757	Software Lab-I - CNS	16ITC104
4758	Seminar-I	16ITC105
4759	Soft Skills Lab	16EGC104
4760	Information Systems Security	16ITC201
4761	Big Data Analytics	16ITC202
4762	Advanced Algorithms	16ITC203
4763	Mobile Adhoc and Sensor Networks	16ITE243
4764	Cloud Computing	16ITE251
4765	Digital Image Processing & Computer Vision	16ITE263
4766	Lab-II BDA	16ICT204
4767	Seminar-II	16ITC205
4768	Mini Project	16ITC206
4769	Project Seminar	16ITC301
4770	Project Work and Dissertation	16ITC401
4771	Engineering Mathematics - I	16MT C01
4772	Engineering Chemistry	16CY C01
4773	Applied Physics	16PY C02
4774	Programming and Problem Solving	16CS C01
4775	Elements of Mechanical Engineering	16ME C01
4776	Elements of Electronics and Communication Engineering	16EC C01
4777	Professional Ethics and Human Values	16CE C03
4778	Programming Laboratory	16CS C02

4779	Mechanical and IT Workshop	16ME C03
4780	Applied Physics Laboratory	16PY C04
4781	Engineering Chemistry Laboratory	16CY C03
4782	Engineering Mathematics - II	16MT C02
4783	Engineering Physics	16PY C01
4784	Applied Chemistry	16CY C02
4785	Elements of Electrical Engineering	16EE C01
4786	Engineering Mechanics	16CE C01
4787	Professional Communication in English	16EG C01
4788	Environmental Studies	16CE C02
4789	Engineering Graphics	16ME C02
4790	Engineering Physics Laboratory	16PY C03
4791	Applied Chemistry Laboratory	16CY C04
4792	Professional Communication Laboratory	16EG C02
4793	Engineering Mathematics – III	16MTC05
4794	Electrical Circuits – I	16EEC02
4795	Electrical Measurements & Instruments	16EEC03
4796	Electronics Engineering	16ECC16
4797	Prime Movers & Pumps	16MEC11
4798	Engineering Economics & Accountancy	16MBC01
4799	Circuits & Measurements Lab	16EEC04
4800	Electronics Engineering Lab	16ECC17
4801	Prime Movers & Pumps Lab	16MEC12
4802	Electrical Circuits -II	16EE C06
4803	Electrical Machinery - I	16EE C07
4804	Power Systems - I	16EE C08
4805	Electromagnetic Theory	16EE C09
4806	Digital Electronics and Logic Design	16EE C10
4807	Linear Integrated Circuits	16EE C11
4808	Electrical Machinery - I Lab	16EE C12
4809	Linear Integrated Circuits Lab	16EE C13
4810	Soft Skills and Employability Enhancement Lab	16EG C03
4811	Power Systems – II	EE 311
4812	Electrical Machinery – II	EE 312
4813	Linear Control Systems	EE 313
4814	Power Electronics	EE 314
4815	Linear Integrated Circuits	EE 315
4816	Human Values and Professional Ethics	CE 444
4817	Electrical Machinery – I Lab	EE 316
4818	Control Systems Lab	EE 317
4819	Linear Integrated Circuits Lab	EE 318
4820	Electrical Machinery – III	EE 321
4821	Switch Gear & Protection	EE 322
4822	Microprocessor & Microcontrollers	EE 323
4823	Digital Signal Processing	EE 324
4824	Advanced Control System	EE 353
4825	Renewable Energy Systems	EE 354

4826	Power Electronics Lab	EE 325
4827	Microprocessor & Microcontrollers Lab	EE 326
4828	Electrical Machinery – II Lab	EE 327
4829	Mini Project *	EE 328
4830	Power System Operation & Control	EE 411
4831	Power Semiconductor Drives	EE 412
4832	HVDC & FACTS	EE 413
4833	Managerial Economics & Accountancy	MB214
4834	Entrepreneurship (Elective –II)	ME 464
4835	Digital Signal Processing Lab	EE 414
4836	Power Systems Lab	EE 415
4837	Project Seminar	EE 416
4838	Utilization of Electrical Energy	EE 421
4839	Industrial Administration & Financial Management	ME 419
4840	Power Quality Engineering	EE 474
4841	Electrical Distribution Systems	EE 475
4842	IOT of things	IT 429
4843	Disaster Mitigation & Management	CE- 422
4844	Electrical Simulation Lab	EE 422
4845	General Seminar	EE 423
4846	Project	EE 901
4847	Power Semi-Conductor Devices & Circuits	16EEC101
4848	Distribution System Planning and Automation	16EEC102
4849	Flexible AC Transmission Systems	16EEC106
4850	Renewable Energy Sources	16EEE107
4851	Power Quality Engineering	16EEE109
4852	Energy Management	16EEE110
4853	Power Electronics Lab	16EEC108
4854	Seminar – I	16EEC109
4855	Soft Skills Lab	16 EG 104
4856	Advanced Computer Methods in Power Systems	16EEC103
4857	Power System Stability	16EEC104
4858	Advanced Electric Drives	16EEC105
4859	Deregulation of Power Systems	16EEE105
4860	HVDC Transmission	16EEE113
4861	Research Methodology & Professional Ethics	16EEE114
4862	Power Systems Lab	16EEC107
4863	Seminar – II	16EEC110
4864	Mini Project	16EEC111
4865	Project Seminar	16EEC101
4866	Project Work & Dissertation	16EEC103
4867	Engineering Mathematics - I	16MTC01
4868	Engineering Physics	16PYC01
4869	Applied Chemistry	16CYC02
4870	Elements of Electrical Engineering	16EEC01
4871	Engineering Mechanics	16CEC01
4872	Professional Communication in English	16EGC01

4873	Environmental Studies	16CEC02
4874	Engineering Graphics	16MEC02
4875	Engineering Physics Laboratory	16PYC03
4876	Applied Chemistry Laboratory	16CYC04
4877	Professional Communication Laboratory	16EGC02
4878	Engineering Mathematics - II	16MTC02
4879	Engineering Chemistry	16CYC01
4880	Applied Physics	16PYC02
4881	Programming and Problem Solving	16CSC01
4882	Elements of Mechanical Engineering	16MEC01
4883	Elements of Electronics and Communication Engineering	16ECC01
4884	Professional Ethics and Human Values	16CEC03
4885	Programming Laboratory	16CSC02
4886	Mechanical and IT Workshop	16MEC03
4887	Applied Physics Laboratory	16PYC04
4888	Engineering Chemistry Laboratory	16CYC03
4889	Engineering Mathematics-III	16MTC05
4890	Network Theory	16EC C02
4891	Electronic Devices and Circuits	16EC C03
4892	Signals and Systems	16EC C04
4893	Electromagnetic Theory and Transmission Lines	16EC C05
4894	Electronic Workshop and Network Lab	16EC CO6
4895	Electronic Devices Lab	16EC C07
4896	Soft Skills and Employability Enhancement Lab	16EG C03
4897	Digital Logic Design	16EC C08
4898	Analog Electronic Circuits	16EC C09
4899	Analog Communication	16EC C10
4900	Antennas and Wave Propagation	16EC C11
4901	Electronic Instrumentation	16EC C12
4902	Engineering Economics and Accountancy	16MB C01
4903	Digital Logic Design Lab using Verilog	16EC C13
4904	Analog Electronic Circuits Lab	16EC C14
4905	Analog Communication Lab	16EC C15
4906	Linear Integrated Circuits	EC 311
4907	Digital Integrated Circuits	EC 312
4908	Computer Organization and Microprocessors	EC 313
4909	Control Systems Engineering	EC 314
4910	Digital Communication	EC 315
4911	Human Values and Professional Ethics	CE 444
4912	Integrated Circuits Lab	EC 316
4913	Microprocessor and Interfacing Lab	EC 317
4914	Digital Communication Lab	EC 318
4915	Microcontrollers and Applications	EC 321
4916	Microwave Engineering	EC 322
4917	Digital Signal Processing	EC 323
4918	Mobile Cellular Communications	EC 324
4919	Coding Theory and Techniques	EC 351

4920	Optical Fiber Communication	EC 352
4921	CPLD and FPGA Architectures	EC 353
4922	Analog and Mixed IC Design	EC 354
4923	Microcontroller Lab	EC 326
4924	Microwave Lab	EC 327
4925	Digital Signal Processing Lab	EC 328
4926	Radar Systems	EC 411
4927	Data Communications and Computer Networks	EC 412
4928	VLSI Design	EC 413
4929	Electronic Instrumentation	EC 414
4930	Industrial Administration and Financial Management	ME 419
4931	Embedded Systems	EC 462
4932	Satellite Communication	EC 464
4933	Electronic Design and Automation Lab	EC 415
4934	Advanced Simulation Lab	EC 416
4935	Project Seminar	EC 417
4936	GPS and Augmentation Systems	EC 421
4937	Real Time Operating System	EC 472
4938	Digital Image Processing	EC 475
4939	JAVA Programming	CS 486
4940	Entrepreneurship	ME 464
4941	Internet of Things	IT 429
4942	Seminar	EC 422
4943	Project	EC 901
4944	Data and Computer Communication Networks	16ECC101
4945	Probability and Random Processes	16ECC105
4946	Coding Theory and Techniques	16ECC106
4947	Satellite and Microwave Communications	16ECE105
4948	Global Navigational Satellite Systems	16ECE102
4949	Embedded System Design	16ECE111
4950	Communications Lab	16ECC107
4951	Seminar – 1	16ECC109
4952	Soft Skills Lab	16 EG 104
4953	Modern Digital Signal Processing	16ECC102
4954	Detection and Estimation Theory	16ECC103
4955	Wireless Mobile Communication Systems	16ECC104
4956	Optical Fiber Communication Systems	16ECE106
4957	Software Defined and Cognitive Radio	16ECE113
4958	Selected Topics in Strategic Electronics	16ECE119
4959	Computer Communication Networks Lab	16ECC108
4960	Seminar – 2	16ECC110
4961	Mini project	16ECC111
4962	Project work - Project Seminar	16ECC112
4963	Project work - Dissertation	16ECC113
4964	Microcontrollers for Embedded System Design	16EC C201
4965	CMOS VLSI Design	16EC C202
4966	Analog and Mixed Signal IC Design	16EC C205

4967	Computer Communication Networks	16EC E201
4968	VLSI Technology	16EC E206
4969	Optimization Techniques	16EC E213
4970	Design and Simulation Laboratory-I	16EC C207
4971	Seminar - 1	16EC C209
4972	Soft Skills	16 EG 104
4973	RF IC Design	16EC C203
4974	Embedded Processors and Architecture	16EC C204
4975	Real Time Operating Systems	16EC C206
4976	VLSI Physical Design Automation	16EC E210
4977	Low Power VLSI Design	16EC E207
4978	CPLD & FPGA Architectures and Applications	16EC E204
4979	Design and Simulation Laboratory-II	16EC C208
4980	Seminar - 2	16EC C210
4981	Mini Project	16EC C211
4982	Project work -Project Seminar	16EC C212
4983	Project work and Dissertation	16EC C213
4984	Principles of Management	16MBC101
4985	Managerial Economics	16MBC102
4986	Financial Accounting and Analysis	16MBC103
4987	Marketing Management	16MBC104
4988	Statistics for Management	16MBC105
4989	Business Communication	16MBC106
4990	Business Law	16MBC107
4991	Information Technology Applications for Business	16MBC108
4992	InformationTechnology (IT) Lab	16MB C109
4993	Soft Skills Lab	16EG C103
4994	Organisation Behaviour	16MB C110
4995	Business Environment and Ethics	16MB C111
4996	Human Resource Management	16MB C112
4997	Financial Management	16MB C113
4998	Business Research Methods	16MB C114
4999	Operations Research	16MB C115
5000	Operations Management	16MB C116
5001	Business Analytics	16MB C117
5002	Strategic Management Accounting	16MB C120
5003	International Business	16MB C121
5004	Strategic Management	16MB C122
5005	Investment Management	16MB E101
5006	International Finance	16MB E102
5007	Performance and Compensation Management	16MB E103
5008	Organizational Development and Change Management	16MB E104
5009	Product and Brand Management	16MB E105
5010	Promotion and Distribution Management	16MB E106
5011	Total Quality Management	16MB E107
5012	Technology Management	16MB E108
5013	Relational Database Management Systems	16MB E109

5014	E-Business	16MB E110
5015	Logistics and Supply Chain Management	16MBC124
5016	Entrepreneurial Development	16MBC125
5017	Financial Risk Management	16MBE111
5018	Banking and Insurance	16MBE112
5019	Industrial Relations and Labor Laws	16MBE113
5020	Talent and Knowledge Management	16MBE114
5021	Consumer Behaviour	16MBE115
5022	Services and Retail Marketing	16MBE116
5023	Services Operations Management	16MBE117
5024	Enterprise Resource Planning	16MBE118
5025	Cloud Computing and Internet of Things	16MBE119
5026	Principles of Management	16MBC101
5027	Managerial Economics	16MBC102
5028	Financial Accounting and Analysis	16MBC103
5029	Marketing Management	16MBC104
5030	Statistics for Management	16MBC105
5031	Business Communication	16MBC106
5032	Business Law	16MBC107
5033	Information Technology Applications for Business	16MBC108
5034	InformationTechnology (IT) Lab	16MB C109
5035	Soft Skills Lab	16EG C103
5036	Organisation Behaviour	16MB C110
5037	Business Environment and Ethics	16MB C111
5038	Human Resource Management	16MB C112
5039	Financial Management	16MB C113
5040	Business Research Methods	16MB C114
5041	Operations Research	16MB C115
5042	Operations Management	16MB C116
5043	Business Analytics	16MB C117
5044	Statistical Software Lab	16MB C118
5045	Strategic Management Accounting	16MB C120
5046	International Business	16MB C121
5047	Strategic Management	16MB C122
5048	Investment Management	16MB E101
5049	International Finance	16MB E102
5050	Performance and Compensation Management	16MB E103
5051	Organizational Development and Change Management	16MB E104
5052	Product and Brand Management	16MB E105
5053	Promotion and Distribution Management	16MB E106
5054	Total Quality Management	16MB E107
5055	Technology Management	16MB E108
5056	Relational Database Management Systems	16MB E109
5057	E-Business	16MB E110
5058	Logistics and Supply Chain Management	16MBC124
5059	Entrepreneurial Development	16MBC125
5060	Financial Risk Management	16MBE111

5061	Banking and Insurance	16MBE112
5062	Industrial Relations and Labor Laws	16MBE113
5063	Services and Retail Marketing	16MBE116
5064	Enterprise Resource Planning	16MBE118
5065	Cloud Computing and Internet of Things	16MBE119
5066	Engineering Mathematics - I	16MT C 01
5067	Engineering Chemistry	16CY C 01
5068	Applied Physics	16PY C 02
5069	Programming and Problem Solving	16CS C 01
5070	Elements of Mechanical Engineering	16ME C 01
5071	Elements of Electronics and Communication Engineering	16EC C 01
5072	Professional Ethics and Human Values	16CE C 03
5073	Programming Laboratory	16CS C 02
5074	Mechanical and IT Workshop	16ME C 03
5075	Applied Physics Laboratory	16PY C 04
5076	Engineering Chemistry Laboratory	16CY C 03
5077	Engineering Mathematics - II	16MT C 02
5078	Engineering Physics	16PY C 01
5079	Applied Chemistry	16CY C 02
5080	Elements of Electrical Engineering	16EE C 01
5081	Engineering Mechanics	16CE C 01
5082	Professional Communication in English	16EG C 01
5083	Environmental Studies	16CE C 02
5084	Engineering Graphics	16ME C 02
5085	Engineering Physics Laboratory	16PY C 03
5086	Applied Chemistry Laboratory	16CY C 04
5087	Professional Communication Laboratory	16EG C 02
5088	Engineering Mathematics-III	16MT C 03
5089	Chemical Technology	16CH C 01
5090	Fluid Mechanics	16CH C 02
5091	Material and Energy Balance	16CH C 03
5092	Physical Chemistry	16CY C 07
5093	Engineering Economics and Accountancy	16MB C 01
5094	Chemical Technology Lab	16CH C 04
5095	Physical Chemistry Lab	16CY C 08
5096	Basics of Mechanical and Electrical Engg. Lab	16ME C 13 /16EE C 05
5097	Chemical Engineering Thermodynamics - I	16CH C 05
5098	Chemical Reaction Engineers - I	16CH C 06
5099	Material Science for Chemical Engineers	16CH C 07
5100	Mechanical Unit Operations	16CH C 08
5101	Process Heat Transfer	16CH C 09
5102	Advanced Organic Chemistry	16CY E 01
5103	Numerical Techniques and Statistical Methods	16MT E 01
5104	Fertilizer Technology	16CH E 01
5105	Fluid Mechanics Lab	16CH C 10
5106	Programming Laboratory for Numerical Methods	16MT C 07
5107	Soft Skills and Employability Enhancement Lab	16EG C 03

5108	Chemical Reaction Engineering – II	CH 311
5109	Mass Transfer Operations – I	CH 312
5110	Process Dynamics and Control	CH 313
5111	Process Heat Transfer	CH 314
5112	Process Instrumentation	CH 315
5113	Human Values and Professional Ethics	CE 444
5114	Chemical Reaction Engineering Lab	CH 316
5115	Process Heat Transfer Lab	CH 317
5116	Soft Skills and Employability Enhancement	EG 221
5117	Bio Chemical Engineering	CH 321
5118	Chemical Engineering Thermodynamics - II	CH 322
5119	Energy Engineering	CH 323
5120	Process Modeling Simulation and Optimization	CH 324
5121	Surface Coatings Technology	CH 351
5122	Technology of Vegetable oils and Fats	CH 352
5123	Process Dynamics and Control Lab	CH 325
5124	Process Modeling Simulation And Optimization Lab	CH 326
5125	Surface Coatings Technology Lab	CH 355
5126	Technology of Vegetable oils and Fats Lab	CH 356
5127	Chemical Process Safety	CH 411
5128	Mass Transfer Operations -II	CH 412
5129	Petrochemical Engineering	CH 413
5130	Principles and Practice of Management	MB 216
5131	Process Equipment Design	CH 414
5132	Fertilizer Technology	CH 461
5133	Membrane Separation Processes	CH 462
5134	Mineral Processing Technology	CH 463
5135	Polymer Technology	CH 464
5136	Pulp and Paper Technology	CH 465
5137	Equipment Design and Drawing	CH 415
5138	Mass Transfer Operations Laboratory	CH 416
5139	Project Seminar	CH 417
5140	Plant Design and Economics	CH 421
5141	Transport Phenomena	CH 422
5142	Corrosion Engineering	CH 471
5143	Fluidization Engineering	CH 472
5144	Pollution Control in Process Industries	CH 473
5145	Sugar Technology	CH 474
5146	Disaster Mitigation and Management	CE 422
5147	Entrepreneurship	ME 464
5148	Nano Materials and Technology	PE 484
5149	Nuclear Engineering	CH 481
5150	Seminar	CH 423
5151	Project	CH 901
5152	Surveying	16CE C03
5153	Building Materials Planning and Construction	16CE C04
5154	Strength of Materials-I	16CE C05

5155	Engineering Geology	16CE C06
5156	Engineering Mathematics-III	16MT C05
5157	Engineering Economics and Accountancy	16MB C01
5158	Surveying Lab-I	16CE C07
5159	Engineering Geology Lab	16CE C08
5160	Computer Aided Civil Engineering Drafting Lab	16CE C09
5161	Transportation Engineering	16CE C10
5162	Construction Management and Administration	16CE C11
5163	Water and Waste Water Engineering	16CE C12
5164	Strength of Materials-II	16CE C13
5165	Fluid Mechanics-I	16CE C14
5166	Strength of Materials Lab	16CE C15
5167	Surveying –II Lab	16CE C16
5168	Soft Skills and Employability Enhancement Lab	16EG C03
5169	Survey Camp	16CE C17
5170	Project Seminar (III Sem)	16CEC208
5171	Dissertation(III & IV Sem)	16CEC209

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTOMOUNS)

Affiliated to OU; Accredited by NBA;
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Gandipet, Hyderabad – 500075

Scheme of Regulations, Instruction, and Syllabi
of
CHOICE BASED CREDIT SYSTEM (CBCS)
of
BE I TO VIII SEMESTERS OF
FOUR YEAR DEGREE COURSE

IN

COMPUTER SCIENCE & ENGINEERING

TABLE OF CONTENTS

Choice Based Credit System (CBCS) - Rules

The CBCS is applicable to the students who are admitted to BE/B.Tech.(Eight Semesters) programme from the academic year 2016-2017. The preliminary definitions and nomenclature are furnished in the following table.

Sl. No	Key Words	Definition
1.	Programme	An educational programme leading to award of a Degree **BE/B.Tech.**
2.	Admission Procedure	As prescribed by Government of Telangana
3.	Academic Year	Two consecutive (one odd + one even) semesters constitute one academic year.
4.	Semester	Each semester will consist of 15-17 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be scheduled from July to December and even semester from January to June.
5.	Course	Usually referred to, as 'papers' is a component of a programme. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/tutorials/laboratory work/ project work/ seminars/ Exams/ viva/ assignments/presentations/self-study etc. or a combination of some of these. The medium of instruction, examinations and project report will be in English
6.	Credit	A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work per week.
7.	CBCS	Choice Based Credit System (CBCS), provides choice for students to select from the prescribed courses.
8.	CBSS	Credit Based Semester System (CBSS), the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.
9.	Letter Grade	It is an index of the performance of students in a said course. Grades are denoted by letters like O, A++, A, A,B+, B, C etc.
10.	Grade Point	It is a numerical weight allotted to each letter grade on a 10-point scale.
11.	Credit Point	It is the product of grade point and number of credits for a course.
12.	SGPA	Semester Grade Point Average (SGPA), it is a measure of performance of work done in a semester. It is ratio of total credit points secured by astudent in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.
13.	CGPA	Cumulative Grade Point Average (CGPA), it is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.
14.	Transcript or GradeCard or Certificate	Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (Course title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

Types of Courses in the Programme:

Courses in a programme may be of three kinds: Core, Elective and Foundation.

Core Course:

There may be a core course in every semester. This is the course which is to be compulsorily studied by astudent as a core requirement to complete the requirement of a programme in a said discipline of study.

Elective Course:
Elective course is a course which can be chosen from a pool of papers and they may be:

- Supportive to the discipline of study/ Program Specific
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain/Inter discipline
- Nurturing student's proficiency/skill.

An elective may be "Generic Elective/ Inter disciplinary Elective" focusing on those courses which add generic proficiency to the students. An elective may be "Discipline centric/Program Specific "or may be chosen from another discipline. It may be an "Open Elective".

Foundation Course:
Foundation courses are the courses which based upon the content that leads to Knowledge enhancement. They are mandatory for all disciplines. The other foundation courses are value-based and are aimed at man-making education.

Mandatory Learning Courses:
These are the courses that must be completed by the student before the course completion. For example the courses on "Professional Ethics and Human Values" and "Environmental studies" are mandatory learning courses.

Course Structure: The following table shows the course structure with the credit Weightage distribution.

S. No	Description	Credits	%	Syllabus Requirements
1.	Foundation Course : Basic Science Core Courses (BSC) -24 Engineering Science Core Courses(ESC)-22 Humanities and Social Science Core Courses(HSC) -08 Mandatory Learning Courses (MLC) -02	56	30	Compulsory
2.	Core Courses :	88	47	
3.	Elective Courses :Program specific electives (PSE) , Inter-disciplinary / Open electives.	30	16	A wide choice to the student to choose for the electivecourses listed in the structure. Program specific electives: 7Inter Disciplinary/Open Electives 3 **Total Elective Courses : 10**
4.	Mini Project, Project, Seminars	14	07	Compulsory
	Total	188	100	

Examination and Assessment:
In assessing the performance of the students in examinations, the approach is to award marks based on the examinations conducted at various stages (sectionals and end exam) in a semester. Converting of these marks to letter grades based on absolute and award the grades. As per the UGC recommendations, the following system will be implemented in awarding the grades and CGPA under the credit based semester system.

Letter Grades and Grade Points:
The absolute grading mechanism is followed in mapping the letter grades. The marks are converted to grades based on pre-determined class interval. As per the UGC recommendations a 10-point grading system with the following letter grades are followed. The same is furnished in the following table.

% of Marks	**Grade points**	**Letter Grade**	**Grade description**
90.00-100	9.00-10	O	Outstanding
80.00-89.99	8.00-8.99	A++	Excellent
70.00-79.99	7.00-7.99	A+	Very good
60.00-69.99	6.00-6.99	A	Good
55.00-59.99	5.50-5.99	B+	Fair
50.00-54.99	5.00-5.49	B	Above Average
45.00-49.99	4.50-4.99	C+	Average
40.01-44.99	4.01-4.49	C	Below average
40	4.00	D	Pass
<40	0.00	F	Fail
----	0.00	Ab	Absent

A student obtaining Grade F shall be considered failed and will be required to reappear in the examination. For non-credit courses 'Satisfactory' or "Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

Computation of SGPA and CGPA:

The computations of SGPA and CGPA are followed as per the UGC guidelines.

The **SGPA** is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

SGPA (Si) = Σ(Ci x Gi) / ΣCi

where **Ci** is the number of credits of the i^{th} course and **G**i is the grade point scored by the student in the i^{th} course.

The **CGPA** is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

CGPA = Σ(Ci x Si) / Σ Ci

where **Si** is the SGPA of the i^{th} semester and **Ci** is the total number of credits in that semester. The **SGPA** and **CGPA** shall be rounded off to 2 decimal points and reported in the transcripts.

Transcript/Grade Sheet (Format): Based on the above guidelines on Letter grades, Grade points and SGPA and CCPA, the institute issues the transcript/grade certificate for each semester and a consolidated transcript/grade certificate indicating the performance in all semesters.

Contact hours and credits:

The norms for course credits are as follows:

Lecture (L)/Tutorials (T):One (1) hour per week is assigned one(1) credit(C).

Practical (P): Two (2) hours session per week is assigned one(1) credit(C).

For example, a theory course with a L-T-P schedule of 2-1-0 will be assigned three (3) credits.

L	T	P	C
2	1	0	3

A laboratory practical course with a L-T-P schedule of 0-1-2 will be assigned two (2) credits.

L	T	P	C
0	1	2	2

List of Foundation Courses:

(Common Civil, Chemical, CSE, ECE, EEE, IT, Mech. and Prod. disciplines)

Basic science core courses (BSC) **19-1-8-24**

1. Engineering Mathematics-I	3-1-0-4	
2. Engineering Mathematics-II	3-0-0-3	
3. Engineering Mathematics-II I	3-0-0-3	
4. Engineering Physics	3-0-0-3	
5. Engineering Chemistry	3-0-0-3	
6. Applied Physics	2-0-0-2	
7. Applied Chemistry	2-0-0-2	
8. Engg. Physics Laboratory	0-0-2-1	
9. Engg. Chemistry Laboratory	0-0-2-1	
10. Applied Physics Lab	0-0-2-1	
11. Applied Chemistry Lab	0-0-2-1	
Engineering Science Core courses (ESC)		**16-1-8-22**
1. Engineering Mechanics	3-0-0-3	
2. Elements of EE	3-0-0-3	
3. Elements of ECE	3-0-0-3	
4. Elements of ME	3-0-0-3	
5. Engineering Graphics	1-0-3-3	

6. Programming and Problem Solving	3-1-0-4	
7. Programming Laboratory	0-0-2-1	
8. Mechanical and IT Workshop	0-0-3-2	
Humanities and Social Science Core Courses (HSC) 1. Professional Communication in English	3-0-0-3	**6-0-4-8**
2. Professional Communication Lab	0-0-2-1	
3. Engg. Economics& Accountancy	3-0-0-3	
4. Soft Skills Lab	0-0-2-1	
Mandatory Learning Courses (MLC)		**2-0-0-2**
1. Environmental Studies	1-0-0-1	
2. Professional Ethics and Human values	1-0-0-1	

Total (Foundation courses): 43-2-20-56

Plan of Study of I-semester and II-semester:

The plan of study along with the course titles are furnished in the following table and it is common to alldisciplines except Bio-Technology.

B.E(CSE, ECE and IT) Eight(8) Sections			
Semester-I		**Semester-II**	
Engineering Mathematics-I	3-1-0-4	Engineering Mathematics-II	3-0-0-3
Engineering Physics	3-0-0-3	Engineering Chemistry	3-0-0-3
Applied Chemistry	2-0-0-2	Applied Physics	2-0-0-2
Engg. Physics Laboratory	0-0-2-1	Engg. Chemistry Laboratory	0-0-2-1
Applied Chemistry Lab	0-0-2-1	Applied Physics Lab	0-0-2-1
Engineering Mechanics	3-0-0-3	Elements of ME	3-0-0-3
Elements of EE	3-0-0-3	Elements of ECE	3-0-0-3
Engineering Graphics	1-0-3-3	Programming and Problem Solving	3-1-0-4
Professional Communication in English	3-0-0-3	Programming Laboratory	0-0-2-1
Professional Communication Lab	0-0-2-1	Mechanical and IT Workshop	0-0-3-2
Environmental Studies	1-0-0-1	Professional Ethics and Human values	1-0-0-1
Total	19-1-9-25	Total	18-1-9-24
Work Load	**: 29 (Hours / per week)**	**Work Load:**	**: 28 (Hours / per week)**

B.E(Civil, EEE, Mech. and Prod.) and B.Tech. Chemical) Eight(8) Sections			
Semester-I		**Semester-II**	
Engineering Mathematics-I	3-1-0-4	Engineering Mathematics-II	3-0-0-3
Engineering Chemistry	3-0-0-3	Engineering Physics	3-0-0-3
Applied Physics	2-0-0-2	Applied Chemistry	2-0-0-2
Engg. Chemistry Laboratory	0-0-2-1	Engg. Physics Laboratory	0-0-2-1
Applied Physics Lab	0-0-2-1	Applied Chemistry Lab	0-0-2-1
Elements of ME	3-0-0-3	Engineering Mechanics	3-0-0-3
Elements of ECE	3-0-0-3	Elements of EE	3-0-0-3
Programming and Problem Solving	3-1-0-4	Professional Communication in English	3-0-0-3
Programming Laboratory	0-0-2-1	Professional Communication in English Lab	0-0-2-1
Mechanical and IT Workshop	0-0-3-2	Environmental Studies	1-0-0-1
Professional Ethics and Human values	1-0-0-1	Engineering Graphics	1-0-3-3
Total	18-2-9-25	Total	19-0-9-24
Work Load:	**: 29 (Hours / per week)**	**Work Load**	**: 28 (Hours / per week)**

List of Foundation Courses: (For Bio-Technology discipline only)

Basic science core courses (BSC)		21-1-8-26
1. Engineering Mathematics-I/Basics of Biology-I	3-1-0-4	
2. Engineering Mathematics-II / Basics of Biology-II	3-0-0-3	
3. Engineering Mathematics-II I	3-0-0-3	
4. Engineering Physics	3-0-0-3	
5. Engineering Chemistry	3-0-0-3	
6. Bio Physics	3-0-0-3	
7. Bio Chemistry	3-0-0-3	
8. Engg. Physics Laboratory	0-0-2-1	
9. Engg. Chemistry Laboratory	0-0-2-1	
10. Bio Physics Lab	0-0-2-1	
11. Bio Organic Chemistry Lab	0-0-2-1	

Engineering Science Core courses (ESC)		**14-1-8-20**
1. Elements of Bio-Technology	3-0-0-3	
2. Elements of EE	3-0-0-3	
3. Introduction to Anatomy		
and Physiology of Humans	4-0-0-4	
4. Engineering Graphics	1-0-3-3	
5. Programming and Problem Solving	3-1-0-4	
6. Programming Laboratory	0-0-2-1	
7. Mechanical and IT Workshop	0-0-3-2	
Humanities and Social Science Core Courses (HSC)		**6-0-4-8**
1. Professional Communication in English	3-0-0-3	
2. Professional Communication Lab	0-0-2-1	
3. Engg. Economics & Accountancy	3-0-0-3	
4. Soft Skills Lab	0-0-2-1	
Mandatory Learning Courses (MLC)		**2-0-0-2**
1. Environmental Studies	1-0-0-1	
2. Professional Ethics and Human values	1-0-0-1	

Total (Foundation courses) : 43-2-20-56

Plan of Study of I-Sem and II-Sem for B.Tech (Bio-Technology):
The plan of study along with the course titles are furnished in the following for Bio-Technologydiscipline.

Semester-I		**Semester-II**	
Engg. Mathematics-I /Basics of Biology-I	3-1-0-4	Engg. Mathematics-II/ Basics of Biology-II	3-0-0-3
Engineering Chemistry (3Hrs)	3-0-0-3	Bio Physics(3Hrs)	3-0-0-3
Engg. Physics(3Hrs)	3-0-0-3	Bio Physics Laboratory	0-0-2-1
Engg. Chemistry Laboratory	0-0-2-1	Bio-Organic Chemistry	3-0-0-3
Engg.Physics Lab	0-0-2-1	Bio-Organic Chemistry Lab	0-0-2-1
Elements of EE	3-0-0-3	Introduction to Anatomy And Physiology of Humans	4-0-0-4

Elements of Bio-Technology	3-0-0-3	Programming and Problem Solving	3-1-0-4
Professional Communication in English	3-0-0-3	Programming Laboratory	0-0-2-1
Professional Communication Lab	0-0-2-1	Mechanical and IT Workshop	0-0-3-2
Engineering Graphics	1-0-3-3	Environmental Studies	1-0-0-1
		Profnl. Ethics& Human values	1-0-0-1
Total	19-1-9-25	Total	18-1-9-24
Work Load: :	**29 (Hours / per week)**	**Work Load**	**: 28 (Hours / per week)**

Plan of Study of III-VIII Sem of B.E/B.Tech. (Curriculum) :

The plan of study from III-semester to IV-semester is furnished in the following table and it is common toall the disciplines of B.E/B.Tech.

Semester	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
1.	Engg. MathsIII (BS) (3)	Core Course / Engg. Maths(4)	Core Course (4)	Core Course (4)	Core Course (4)	**Elective (3)**
2.	Core Course (4)	Core Course (4)	Core Course (4)	Core Course (4)	Core Course (4)	**Elective (3)**
3.	Core Course(4)	Core Course(4)	Core Course (4)	Core Course (4)	Core Course (4)	**Elective (3)**
4.	Core Course(4)	Core Course(4)	**Elective (3)**	**Elective (3)**	**Elective (3)**	**Seminar(2)**
5.	*Engg. Eco and Accountancy (3) (HSC)	**Elective (3)**	**Elective (3)**	**Elective (3)**	**Elective (3)**	**Project(06) (Load: 06 Hours/ Week)**
6.	Core Lab(2)	Core Lab(2)	Core Lab(2)	Core Lab(2)	Core Lab(2)	
7.	Core Lab(2)	Core Lab(2)	Core Lab(2)	Core Lab(2)	Core Lab(2)	
8.	Mini-Project(1)	**Soft Skills (1)(HSC)	Core Lab(2)	Core Lab(2)	**Project seminar(2)**	
9.		Mini-Project(1)	Mini-Project(1)	Mini-Project(1)		
	BS-3 EHSC-3 Core-16 Mini-Proj-1 Total=23	Core -20 Elective-3. Mini-Proj-1 Total=25	**Core-18** **Elective-6** Mini-Proj-1 **Total-25**	**Core-18** **Elective-6** Mini-Proj-1 **Total-25**	**Core-16** **Elective-6** **Proj sem-2** **Total-24**	**Elective-09** **Proj and Sem=08** **Total-17**

*Eight(8) sections will have “Engg. Eco and Accountancy” in III-Sem and the remaining nine(9) sectionswill have “Engg. Eco and Accountancy” in IV-Sem.

**Nine(9) sections will have “Soft Skills” in III-Sem and the remaining eight(8) sections will have “SoftSkills” in IV-Sem

SUMMARY

Semester	Credits	Hours per Week
I.	25	29
II.	24	28
III.	23	26
IV.	25	29
V.	25	29
VI.	25	29
VII.	24	27
VIII.	17	18
Total	**188**	

Foundation Courses	56
Mini Proj/Project/Seminar	14
Core	88
Electives*	30
Total	**188**

***** Program specific electives(7)
Inter Disciplinary Electives /Open Electives(3)

Total Elective Courses : 10

The time-table is prepared with the following timings:

1st Hour	2nd Hour	3rd Hour	Lunch	4th Hour	5th Hour	6th Hour
09:40-10:40	10:40-11:40	11:40-12:40	12:40-13:20	13:20-14:20	14:20-15:20	15:20-16:20

Credit requirements for the award of degree, lower limit and upper limit of credits for registrationby a student in a semester

Credit Requirement for the award of B.E/B.Tech. degree is **185.**
The lower and upper limit for course credits registered in a semester by a student of B.E/B.Tech.program:

Lower Limit: 21 Credits	Upper Limit: 28 Credits

Industrial Training / Internship

The students may undergo Industrial training/Internship during summer / winter vacation. In this case the training has to be undergone continuously for the entire period.

The students may undergo Internship at Research organization / University (after due approval from the Head of the Department) during summer / winter vacation or during semester break.

Duration of Training/Internship	Credits
2 Weeks	1
4 Weeks	2
6 Weeks	3

If Industrial Training / Internship are not prescribed in the curriculum, the student may undergo Industrial Training / Internship optionally and the credits earned will be indicated in the Mark Sheet. If the student earns three (3) credits in Industrial Training / Internship, the student may drop one 'Open Elective'. **In such cases Industrial Training / Internship needs to be undergone continuously from one organization only**.

However, if the number of credits earned is 1 or 2, these credits shall not be considered for dropping any elective or in process of award of degree. The student is allowed to undergo a maximum of 6 weeks Industrial Training / Internship during the entire duration of study, no credits will be allotted for the internship beyond six(6) weeks.

The detailed procedures are furnished in the **ANNEXURE**(Page: 14), regarding the earning of credits by the student for **Industrial Training / Internship**

Industrial Visit

Every student is required to go for at least two industrial visits during the IV-semester to VII-semester of the Programme. The Heads of Departments shall ensure that necessary arrangements are made in this regard. **It is non-credit course and is awarded with 'Satisfactory/Un-satisfactory' and will be reflected in grade sheet.**

Duration of the programmes

A student is normally expected to complete the B.E. / B.Tech. Programme in 8Semesters but in any case not more than 16 Semesters. Each semester shall normally consist of 90 teaching days (including examination days). The Head of the Department shall ensure that every teacher imparts instruction as per the number of hours specified in the syllabus covering the full content of the syllabus for the course beingtaught.

Course enrolment and registration

Each student, on admission shall be assigned to a Faculty Advisor who shall advice and counsel the student about the details of the academic programme and the choice of courses considering the student's academic background and career objectives.

Each student on admission shall register for **all the courses prescribed in the curriculum in** the student's **first Semester of study.**

Every student shall enrol for the course of the succeeding semester in the current semester. However, the student shall confirm the enrolment by registering for the courses within the first five working days after the commencement of the concerned semester.

No course shall be offered by a Department unless a minimum of 30 students register for that core course and15 students for elective course. After registering for a course, a student shall attend the classes, to satisfy the attendance requirements for attending the semester end examinations.

The enrolment for all the courses of the Semester II will commence 10 working days prior to the last working day of Semester I. The student shall confirm the enrolment by registering for the courses within the first five working days after the commencement of the Semester II. However, the student is allowed toregister for courses for which the student has not enrolled, if these are the courses in which the student hasfailed.

The enrolment for the courses of the Semesters III to VIII will commence 10 working days prior to the last working day of the preceding semester. The student shall enrol for the courses with the guidance of the student's Faculty Advisor. If the student wishes, the student may drop or add courses within **five** working days after the commencement of the concerned semester and complete the registration process duly authorized by the Faculty Advisor. The student is allowed to register for courses for which the student has not enrolled, if these are the courses in which the student has failed.

A student has to earn the total number of credits specified in the curriculum of the respective Programme of study in order to be eligible to obtain the degree. However, if the student wishes, then the student is permitted to earn more than the total number of credits prescribed in the curriculum of the student's programme.

From the III to VIII semesters, the student has the option of registering for additional courses or dropping existing courses. Total number of credits of such courses cannot exceed 6. However the maximum number of credits the student can register in a particular semester cannot exceed28 credits.

The student shall register for the project work in the VII semester only.

If a student fails in a theory course/lab course, the student has to register for semester end exam in the subsequent semester for earning the credits for that failed course.

If a student is prevented from writing end semester examination due to lack of attendance, the student has to register for all the courses again, when offered next, attend the classes and fulfil the attendance requirements.

A student can apply for revaluation of the student's semester examination answer paper in a theorycourse, within 2 weeks from the declaration of results, on payment of a prescribed fee along with prescribed application

Promotion Rules :

The promotion rules for from one semester to another semester are furnished in the following table:

S.No.	Semester	Conditions to be fulfilled
1.	From I-Sem to II-Sem	Regular course of study of I-Sem.
2.	From II-Sem to III-Sem	Student Must have earned 24 Credits
3.	From III-Sem to IV-Sem	Regular course of study of III-Sem.
4.	From IV-Sem to V-Sem.	Student must have earned 49Credits of I-Sem and II-Sem, together must have earned 73 credits overalltill IV Sem.
5.	From V-Sem to VI-Sem	Regular course of study of V-Sem
6.	From VI-Sem to VII-Sem	Student must have earned 97 Credits of I-Sem to IV-Sem, together must have earned 122 credits overalltill VI Sem.
7.	From VII-Sem to VIII-Sem	Regular course of study of VII Sem.

Common Course Committee

A theory course handled by more than one teacher shall have a "Common Course Committee" comprisingof all teachers teaching that course and students who have registered for that course. There shall be at least one/two student representatives from each class of that course. One of the teachers shall be nominated as **Course Coordinator** by the Head of the Department.

The first meeting of the Common Course Committee shall be held within fifteen days from the date of commencement of the semester. The nature and weight-age of the continuous assessments like assignments, internal exams and syllabus coverage schedules shall be decided in the first meeting, within the framework of the Regulations.

Two or three subsequent meetings in a semester may be held at suitable intervals**.** During these meetings, the student members shall meaningfully interact and express their opinions and suggestions of all the students to improve the effectiveness of the teaching-learning process. It is the responsibility of the student representatives to convey the proceedings of these meetings to their respective class.

In addition the "Common Course Committee" (without the student representatives) shall meet to ensure uniform evaluation of continuous assessments after arriving at a common scheme of evaluation for the assessments. Wherever feasible, the common course committee (without the student representatives) shallprepare a common question paper for the continuous assessment tests also.

Multiple Courses Committee

Course(s) handled by a single teacher, there will be a "Multiple Courses Committee" comprising of all theabove teachers and two student representatives from each course. One of the above teachers, nominatedby the Head of the Department shall coordinate the activities of this committee. The functions of this committee are similar to that of the common course committee.

Overall Monitoring Committee:

In addition, there shall be an overall monitoring committee for each semester of a programme which comprises of the Course Coordinators / Course teachers (as applicable), the Head of Department. This overall monitoring committee shall meet periodically to discuss academic related matters, progress and status of the students of the semester concerned. The overall monitoring committee can invite the studentsof the semester concerned for any of the committee meetings if necessary.

Assessment Procedures for Awarding Marks

The distribution of marks is based on internal assessment (Sessional) by concerned teacher and the Semester end examination shall be as follows:

Course (in terms of credits)	Sessional (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	20*	50***	Theory	2-Hours
Two(2) Credits	25	50	Lab Course/Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
Two(2) Credits	50	---	Project Seminar/Seminar	----
Six(6) Credits	50	100	Project	Viva
One(1) Credit	---	50***	Environmental Studies, ProfessionalEthics and Human values	2 Hours
One(1) Credit	50		Mini Project	-----

* Out of 30/20 sessional marks, 10/5 marks are allotted for slip-tests(Three slips test will be conducted, each of ten marks, best two average is considered) and the remaining 20 marks are based on the average of two Internal 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 covers the entire syllabus, and carries 20 marks. Part-B carries 50 marks and covers all the units of the syllabus (studenthas to answer five out of seven questions)

***The question paper will be in two parts, Part-A and Part-B. Part A is compulsory and covers the entire syllabus, and carries 15 marks. Part-B carries 35 marks and covers all the units of the syllabus (studenthas to answer five out of seven questions)

Note: A course that has sessional marks but no end examination as per scheme is treated as Pass/Fail course for which pass marks are 50% of Sessionals.

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 end **Examinations plus Sessional marks shall be 40% for theory courses/subjects and 50% for lab courses/ Project.**

RULES AND REGULATIONS OF ATTENDANCE

1. The Degree of Bachelor of Engineering / Technology will be conferred on a candidate who has pursued a 'Regular Course of Study' for eight semesters (six semesters for candidates admitted under lateral entry scheme) as hereinafter prescribed in the scheme of instruction and has earned therequired credits.

2. **i)** A regular course of study for eligibility to appear at the B.E/ B.Tech Examination of any Semester shall mean putting in attendance of not less than 75% aggregate in lectures/theory, Practicals, Drawings, Workshops, Project, Seminars etc. The cumulative monthly attendance in each course and the aggregate attendance shall be displayed on the notice board.

ii) Attendance of N.C.C/N.S.S. Camps or Inter collegiate or Inter University or Inter State or International matches or debates or Educational Excursion or such other Inter University activities as approved by the authorities involving journeys outside the city in which the college is situated will not be counted as absence. However, such absence shall not exceed (4) weeks per semester of the total period of instructions. Such facility should not be availed twice during the course of study.

iii) In any semester of the course if a candidate fails to secure the minimum percentage of attendance, he/she shall not be eligible to appear in the examination of that semester and he/she shall have to enrol himself/ herself to undergo afresh a 'Regular Course of Study' of the corresponding semester in subsequent academic session, in order to become eligible to appear for the examination. **The student need to pay the required tuition fee for that corresponding semester as per institute rules.**

iv) The attendance shall be calculated on the aggregate of the courses/ subjects from the date of commencement of classes / date of readmission in case of detained candidates as per the almanac communicated by the Chaitanya Bharathi Institute of Technology (Autonomous).

v)Candidates admitted to the first semester through an entrance test and do not have the requisite attendance but have not less than 40% attendance can seek readmission without once again appearing for the entrance test again in respect of candidates of such courses where the admissions are governed through an entrance test. Candidates of I-Semester, who do not have the minimum 40% attendance, would lose their seat.

3. **i)** In special cases and for sufficient cause shown, the Principal may, on the specific recommendation of the Head of the Department, condone the deficiency in attendance to the extent of 10% on medical grounds subject to submission of medical certificate and payment of condonation fee.

   ii) However, in respect of women candidates who seek condonation of attendance due to pregnancy, the Principal may condone the deficiency in attendance to the extent of 15% (as against 10% Condonation for others) on medical grounds subject to submission of medical certificate to this effect. Such condonation shall not be availed twice during the course of study.

4. The fee for condonation of attendance on medical grounds shall be Rs.500.00 payable through Demand Draft drawn in favor of the Principal, CBIT, Hyderabad.

Revision of Regulations, Curriculum and Syllabi

The institute may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and Scheme of examinations through the Academic Council's approval.

Eligibility for the award of degree

A student shall be declared to be eligible for the award of the B.E/B.Tech., provided the student has successfully gained the required number of total credits as specified in the curriculum corresponding to the student's programme within the stipulated time.

Successfully completed the course requirements, appeared for the End-Semester examinations and passed all the subjects prescribed in all the 8 semesters within a maximum period of 8 years considered from the commencement of the first semester to which the candidate was admitted.

Successfully passed any additional courses prescribed by the institute whenever readmitted under regulation.

No disciplinary action pending against the student.

The award of Degree must have been approved by the University.

Improvement of overall score

A candidate who wishes to improve his/her overall score may do so within one academic year immediately after having passed all the examinations of the B.E/B.Tech degree course by reappearing to all courses/subjects of any one semester as prescribed by the syllabus and curriculum.

All the rules and regulations, specified herein after shall be read as whole for the purpose of interpretation and when a doubt arises, the interpretation of the Chairman, Academic Council, Chaitanya Bharathi Institute of Technology (Autonomous) is final. As per the requirements of the Statutory Bodies, Principal, Chaitanya Bharathi Institute of Technology (Autonomous), shall be the Chairman of the College Academic Council

ANNEXURE

Industrial Training / Internship

Guide lines for earning three (3) credits by the student towards the Industrial Training/ Internship:

"If the student earns three (3) credits in Industrial Training / Internship, the student may drop one 'Open Elective'. In such cases Industrial Training / Internship needs to be undergone continuously from one organization only, during the semester break/summer vacation "

Procedure for granting permission to the student to carryout Industrial Training / Internship by the student, continuously for at least for six (6) weeks duration from one organization during the semester break/summer vacation:

1. The student needs to approach the respective Head of the department with a request that he/she is interested to carry out an Industrial Training / Internship, with the details of the industry/organisation
2. A committee is constituted in the department which is preceded by the head of department and head nominates one of the senior faculties as a mentor to that student.
3. The mentor visits the industry/organisation and discuss with CEO/Director /Responsible person of that industry/organisation on the following points
   - Duration of the Industrial Training / Internship
   - Nature of work to be carried out by the student
   - Facilities to be extended to the student in the industry
   - Requesting the industry personnel to assign a guide or an in-charge tomonitor the student's work in the industry.
   - Number of man hours to be spend by the student
   - Preparation of documentation/report by the student
   - To apprise the industry personnel that the **Industrial Training /Internship** is equivalent to earning of three(3) credits
4. After having all the required details from the industry personnel, the mentor presents the deliberations made with industry and discusses with the committee to draft the necessary recommendations/conclusions.
5. If the committee recommends then the student is permitted to carry out **Industrial Training / Internship** in that particular industry/organisation, continuously for a minimum of six(6) weeks during the semester break/summer vacation.

Assessment procedure for earnings three (3) credits:

- A minimum of six(6) weeks continuously to be spend by the student in one industry/organisation during the semester break/summer vacation.
- Two (2) midterm evaluations, one at the end of third (3rd) week of Industrial Training / Internship and the other at the end of fifth(5th) week of Industrial Training / Internship are to be carried out by the mentor. The midterm evaluation may be based on oral presentations by the student and a documentary evidence of the work carried out by the student in industry/organisation. For awarding marks for midterm evaluations the mentor has to coordinate with the guide/in-charge of the student in the industry. The midterm evaluations are to be carried out for a maximum 30 Marks.
- After Industrial Training / Internship, the student has to submit a hard copy of the Industrial Training / Internship report in a standard format which is prescribed by the department. Finally, the committee evaluates the performance of the student for a maximum of seventy (70) marks which is equivalent to the semester end examination.
- The student has to deliver power point presentation before the committee on the work which is carried out by the student during Industrial Training /Internship. Committee examines the student and the marks (Maximum 70 Marks) are to be awarded on the following aspects.

Power Point Presentation	: 25 Marks
Hard copy of the Report	: 20 Marks
Viva-Voce	: 25 Marks

The department sends the performance of the student to the CoE for awarding Grade/Grade points towards earning of three (3) credits by the student for Industrial Training / Internship. Based on the result declared by the CoE, the student may be permitted to **drop one “Open Elective”**.

Guide lines for earning one(1)/two(2) credit(s) by the student towards the Industrial Training/ Internship for two(2) to four(4) weeks duration during the semester break or summer/winter vacation:

1. The student needs to approach the respective Head of the department with a request that he/she is interested to carry out an Industrial Training / Internship, with the details of the industry/organisation.
2. The Head of the department issues a letter to the industry with a request to permit the students for Industrial Training / Internship.
3. On Completion of Industrial Training / Internship by the student, the student is required to submit the following to the respective department.
    - Industrial Training / Internship completion certificate from the industry
    - Hardcopy of the report in a standard format which is prescribed by the department
4. Department committee evaluates the student performance on the Industrial Training / Internship for awarding the credits.

Assessment procedure for earning one (1)/two (2) credit(s):

The student has to deliver power point presentation before the committee on the work which is carried out by the student during Industrial Training /Internship. Committee examines the student and the marks **(Maximum :50 Marks, in case of four weeks Industrial Training / Internship, 25 Marks, in case of two weeks Industrial Training / Internship)** are to be awarded on the following aspects

Description	For Four(4) weeks Industrial Training	For Two(2) weeks Industrial Training
	Max. Marks	Max. Marks
Power Point Presentation	25	10
Hard copy of the Report	15	10
Viva-Voce	10	05
Total	50	25

The department sends the performance of the student to the CoE for awarding Grade/Grade points towards earning one(1)/two(2) credit(s)credits by the student for Industrial Training / Internship.

Note: The credits earned by the student towards the Industrial Training/ Internship for two(2) tofour(4) weeks duration during the semester break or summer/winter vacation shall not be considered for dropping any elective or in process of award of degree.

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Institute Vision & 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 & Mission

Vision:

To become a center of excellence in the field of Computer Science and Engineering that produces innovative, skillful and socially responsible professionals who can contribute significantly to industry and research.

Mission:

The mission of Computer Science and Engineering Department is to:

1. To provide a curriculum that balances engineering fundamentals, modern technologies and research.
2. To provide opportunities for solving practical problems.
3. To provide opportunities for overall personality development.

Program Education Objectives (PEOs):

After the completion of the program, our:

1. Practice their profession with confidence by applying new ideas and technologies for the sustainable growth of Industry and Society.
2. To pursue higher studies for professional growth with superior ethics.
3. Engage in Research leading to new products or become a successful entrepreneur.

Program Specific Outcomes (PSOs):

At the end of the program, Graduates able to

1. Knowledge and skills in the areas of Computer Vision and Machine Learning
2. Create Innovative career paths through Open Source Technologies.

B.E. Program Outcomes (PO's)

Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization for the solution of complex engineering problems

Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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 public health and safety, and cultural, societal, and environmental considerations.

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.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.

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.

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.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities with the engineering community and with the 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.

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.

Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Choice Based Credit System (CBCS)

Name of the Programme (UG):

B.E Syllabus for Semester I and II – Semester

with effect from 2016 – 2017

Specialization /Branch: B.E (CSE, ECE and IT)

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
I-Semester of B.E under CBCS
COMPUTER SCIENCE AND ENGINEERING
B.E (CSE, ECE and IT)

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	16MT C01	Engineering Mathematics - I	3/1	0	3	30	70	4
2	16PY C01	Engineering Physics	3	0	3	30	70	3
3	16CY C02	Applied Chemistry	2	0	3	30	70	2
4	16EE C01	Elements of Electrical Engineering	3	0	3	30	70	3
5	16CE C01	Engineering Mechanics	3	0	3	30	70	3
6	16EG C01	Professional Communication in English	3	0	3	30	70	3
7	16CE C02	Environmental Studies	1	0	3	30	70	1
8	16ME C02	Engineering Graphics	1	3	3	30	70	3
PRACTICALS								
9	16PY C03	Engineering Physics Laboratory	-	2	3	25	50	1
10	16CY C04	Applied Chemistry Laboratory	-	2	3	25	50	1
11	16EG C02	Professional Communication Laboratory	-	2	3	25	50	1
TOTAL			**19/1**	**09**	**-**	**255**	**570**	**25**

L - Lecture (clock hours) T - Tutorial (clock hours) P/D - Practical / Drawing (clock hours)

16 MT C01

ENGINEERING MATHEMATICS – I

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

Course Objectives:

1. To solve Linear System of Equations using Matrix Methods
2. To Know the Partial Derivatives and use them to interpret the way a function of two variable behaves
3. To analyse the Shape of the Graph of a given Curve
4. To Evaluate Double and Triple integrals of various functions and their significance
5. Formulate and solve the Differential Equations of First Order
6. To know the methods to solve real life problems.

Course Outcomes: On the successful Completion of this Course student shall be able to

1. Solve system of linear equations and identify the Eigen values and Eigen vector in engineering problems
2. Expand and find extreme values of functions of two variables
3. Trace and interpret curve behavior in physical systems
4. Find the areas, volumes and surface of solids revolution
5. Use-differential equations to model engineering phenomena such as circuit theory, networks
6. An ability to solve the problems and interpret it in geometrical approach

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	-	-		-	-	-	-	1	1	-	-
2	2	2	1	-	-	-	-	-	-	-	1	1	-	-
3	2	2	1	-	1	-	-	-	-	-	1	1	-	-
4	2	2	1	-	1	-	-	-	-	-	1	1	-	-
5	2	2	1	-	1	-	-	-	-	-	1	1	-	-
6	2	2	1	--	1			-	-	-	1	1	-	-

UNIT- I

Linear Algebra: Review of Rank & Consistency, Eigen values, Eigen vectors- properties (without proofs). Cayley-Hamilton Theorem (statement only) inverse and powers of a Matrix by Cayley-Hamilton Theorem. Reduction of Quadratic form to Canonical form by linear transformation, rank, positive, negative, definite, semi-definite, index and signature

UNIT- II

Functions of several variables: Partial differentiations, Homogenous function, Euler's theorem, Implicit functions, Jacobins, Taylor"s series in one and two variables, Maxima and Minima for function of two variables with and without Constraints

UNIT- III

Differential Calculus: Curvature and Radius of curvature centre of curvature, circle of curvature. Evolutes, involutes and Envelopes, Curve tracing-Cartesian, polar and parametric curves

UNIT- IV

Multiple Integrals: Double Integrals, Triple Integrals, Change of order of Integration, Applications of integration, rectification, areas, volumes and surfaces of solids of revolution in Cartesian COordinates, Centre of Gravity, PAPPUS theorem.

UNIT- V

First order differential equations and its application: Exact differential equations, Orthogonal trajectory's, Electrical circuits, Newtons law of Cooling

Professor and Head Department

Text Books:

1. Ervin Kreyszig “Advanced Engineering “ 10 Edition, john wiley & sons -publishers
2. A R.K.Jain&S.R.K.Iyenger “Advanced Engineering Mathematics” , 3rd edition, Narosa Publications
3. AlenJaffery “Mathematics for Engineers and Scientists”, 6th edition : CRC press, Taylor & Francis Group.(Elsevier),2013

Suggested Reading:

1. Kanti.B.Datta “Mathematical Methods of science and engineering”, Aided with MATLAB, .Cengage Learning India Pvt. Ltd, Pratapgang ,New Delhi
2. B.S.Grewal “Higher Engineering Mathematics” , Khanna Publishers
3. William E.Boyce /Richard C.Dip “Elementary differential equations” , 9th Edition

16PY C01

ENGINEERING PHYSICS

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives: The objective of the Course is to make the student
1. Understand the general Concepts of physics
2. Acquire knowledge of different kinds of waves and their behavior
3. Familiar with crystal physics and materials
4. To introduce the general Concepts of physics

Course Outcomes: At the end of the Course, the student will be able to
1. Describe the types of oscillations and analyze them
2. Demonstrate the wave nature of the light
3. Develop the Concepts related to electromagnetic behavior
4. Identify the various crystal systems and defects
5. Explain the origin of magnetism and dielectric polarization and applications of these materials in the field of engineering & technology

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1	1	1	-	-	-	1	-	1	-	-
2	3	3	1	1	1	1	-	-	-	1	-	1	-	-
3	3	3	1	1	1	1	1	-	-	1	-	1	-	-
4	3	3	1	1	1	1	1	-	-	1	-	1	-	-
5	3	3	1	1	1	1	1	-	-	1	-	1	-	-

UNIT – I Waves and Oscillations: Review of free oscillations - Superposition of two mutually perpendicular linear SHMs of same frequency and 1:2 ratio frequency – Lissajous figures – Damped vibrations – Differential equation and its solution – Logarithmic decrement - Relaxation time – Quality factor – Forced vibrations – Differential equation and its solution – Amplitude resonance- Torsional pendulum.
Ultrasonics: Production of ultrasonics by piezoelectric and magnetostriction methods – Detection of ultrasonics – Determination of ultrasonic velocity in liquids – Applications.

UNIT – II Interference: Division of amplitude – Interference in thin films (reflected light) – Newton's rings – & division of wavefront – Fresnel's biprism.
Diffraction: Distinction between Fresnel and Fraunhoffer diffraction – Diffraction at single slit – Diffraction grating (N Slits) – Resolving power of grating.

UNIT – III Polarization: Malus's law – Double refraction – NiCOl's prism – Quarter & Half wave plates – Optical activity – Laurent's half shade polarimeter.
Electromagnetic Theory: Review of steady and varying fields – Conduction and displacement current – Maxwell's equations in differential and integral forms – Electromagnetic wave propagation in free space, dielectric and Conducting media – Poynting theorem.

UNIT – IV Crystallography: Space lattice - Crystal systems and Bravais lattices – Crystal planes and directions (Miller indices) – Interplanar spacing – Bragg's law – Lattice Constant of cubic crystals by powder diffraction method.
Crystal Imperfections: Classification of defects – Point defects – Concentration of Schottky and Frenkel defects – Line defects – Edge dislocation – Screw dislocation – Burger's vector.

UNIT – V Magnetic Materials: Classification of magnetic materials – Langevin theory of paramagnetism – Weiss molecular field theory – Domain theory – Hysteresis curve – Structure of ferrites (spinel & Inverse spinel) – Soft and hard magnetic materials.
Dielectric Materials: Dielectric polarization – Types of dielectric polarization: electronic, ionic, orientation and space-charge polarization (Qualitative) – Frequency and temperature dependence of dielectric polarization – Determination of dielectric constant (Schering bridge method) – Ferroelectricity – Barium titanate – Applications of ferroelectrics.

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 Engineering Physics", S. Chand Publications, 2014.
3. M. Arumugam, "Materials Science", Anuradha Publications, 2015.

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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”, McGahill Education Publications, 2013
3. P.K. Palanisamy, Engineering Physics”, Scitech Publications, 2012
4. V. Raghavan, “Materials Science and Engineering”, Prentice Hall India Learning Private Ltd., 6th Revised edition, 2015

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16CY C02

APPLIED CHEMISTRY

Instruction	2L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	20 Marks
Credits	2

Course Objectives:

Applied chemistry is a fascinating area with the profound implications for engineers as well as biologists. Materials fabricated and used in our daily life are derived from chemicals, both natural and synthetic and their range of utility are growing day by day. It is imperative that engineers of different disciplines acquire sufficient knowledge of the materials and their characteristics for making proper selection of their end -use application.

The various units of the syllabus is so designed to fulfill the following objectives.

1. To impart technological aspects of modern chemistry and to lay foundation for the application of chemistry in engineering and technology disciplines
2. The student should be Conversant with the
   i. Principles of water characterization and treatment of water for potable and industrial purposes.
   ii. Principles of polymer chemistry and engineering applications of polymers in domestic and engineering areas
3. Knowledge to prevent Corrosion of machinery and metallic materials and water chemistry which require serious attention in view of increasing pollution, has been included in the syllabus.
4. Study of polymers is insisted as it gives better insight to industrial personnel by being exposed to wider aspects of polymer science.
5. Study of fuel cells is given importance as fuel cells are the alternate energy sources for generating electrical energy on spot and portable applications.
6. Newer materials lead to discovering of technologies in strategic areas like defense and space research. Recently modern materials synthesized find applications in industry and technology and in order to emphasize them, topics like Composite materials, polymers, Conducting polymers and nano materials have been incorporated in the curriculum.
7. To enable students to apply the knowledge acquired in improving the properties of engineering materials.
8. To give an insight into nano materials and Composite materials aspect of modern chemistry.

Course Outcomes:

1. Identify the various methods used in treatment of water for domestic and industrial use.
2. Illustrate the mechanism of various types of Corrosion & its prevention
3. Discuss the polymers which gives better insight to industrial applications
4. Describe the charging & discharging reactions in batteries & Fuel cells
5. Outline the synthesis of nano materials and their applications
6. Classify the Composite materials and their applications in space technology.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	2	-	2	2	1	-	-	-	2	-	1
2	3	2	2	1	-	2	2	1	-	-	-	2	-	1
3	3	2	2	2	-	2	2	1	-	-	-	2	-	1
4	3	2	3	2	2	2	2	1	-	-	-	2	-	1
5	3	2	3	2	2	2	2	1	-	-	-	2	-	1
6	3	2	2	2	2	1	2	1	-	-	-	2	-	1

UNIT –I

Water Chemistry: Hardness of water – Types, units of hardness, Disadvantages of hard water - Boiler troubles - scales & sludge formation - causes and effects, softening of water by ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water, disinfection of water by chlorination, Ozonization, UV radiation.

UNIT -II

Corrosion Science : Introduction, chemical Corrosion – oxidation Corrosion , electro chemical Corrosion and its mechanism , Galvanic Corrosion and types of differential aeration Corrosion (waterline Corrosion) , Factors affecting Corrosion (position of the metals in galvanic series, relative areas of anode and cathode, nature of Corrosion product – solubility and volatility of Corrosion product, nature of Corroding environment – temperature, humidity and P^H. Corrosion Control methods – catholic protection, sacrificial anodic protection

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UNIT – III

High Polymers: Definition of polymer, degree of polymerization. Thermo plastics and thermo sets. Preparation, properties and uses of plastics (Polyvinyl chloride, Bakelite), fibers (Kevlar, polyurethane), Rubbers – natural rubber and its chemical structure, vulcanization and its significance. Preparation, properties and uses of siliCOne rubber, COnducting polymers – definition, classification and application

UNIT – IV

Battery Technology: Types of batteries - Primary batteries - Dry cell, Lithium battery; SeCOndary batteries - lead acid storage cell , Lithium ion battery ; Fuel cell - H_2-O_2 fuel cell, methanol-oxygen fuel cell – its advantages and applications
Solar cells – photo voltaic cells

UNIT–V

Engineering Materials: Nano materials – Introduction to nano materials and general applications, basic chemical methods of preparation – Sol-gel method. Carbon nanotubes and their applications
Composite materials – definition, types of Composites, fibre reinforced, glass fibre reinforced and carbon fibre reinforced Composites and applications.

Text Books:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Pub, CO., New Delhi (2002)
2. Applied Chemistry "A text for Engineering & Technology" Springer (2005).
3. ShasiChawla, "Text Book of Engineering Chemistry", Dhanpat Rai Publishing Company, NewDelhi (2008).
4. S.S. Dara "A text book of engineering chemistry" S.Chand & CO.Ltd., New Delhi (2006).
5. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.CO.Ltd, New Delhi (2008).
6. Applied Chemistry by N. Krishnamurthy:P. Vallinavagam. And K. Jeysubramanian TMH
7. Chemistry of Engineering Materials by CV Agarwal,C.P Murthy, A.Naidu, BS Publications.
8. Chemistry of Engineering Meterials by R.P Mani and K.N.Mishra, CENGAGE learning

Suggested Reading:

1. B.K.Sharma, "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001)
2. Water Treatment : F. I. Bilane, Mir publisher
3. Fundamentals of Corrosion: Michael Henthorne, Chemical Engineering.
4. A textbook of Polymer Science: Fred, Billmeyer Jr., Wiley India Third edition.
5. Chemistry of Advanced Materials: CNR Rao, Rsc Publication.
6. Materials Science and Engineering an Introduction, William D. Callister, (Jr. Wiley publisher).
7. Introduction to nano materials by T.Pradeep.

Professor and Head Department

16EE C 01

ELEMENTS OF ELECTRICAL ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. To understand the basic Concepts of electrical circuits.
2. To understand the principles of electromagnetic induction.
3. To know about different types of batteries, charging and discharging of batteries and types of fuel cells etc.
4. To know about different types of electrical wires and cables, domestic and industrial wiring.
5. To understand safety rules and methods of earthing.

Course Outcomes: After Completion of the Course, the student will be able to:
1. Acquire the knowledge of basic Concepts of electrical circuits such as Ohm's law, Kirchhorff's laws etc.
2. Acquire the knowledge of basic Faraday's laws of electromagnetic induction.
3. Acquire the knowledge to solve the problem of AC circuits.
4. Acquire the knowledge of specifications of batteries, types of cells and sources of renewable energy.
5. Acquire the knowledge of electrical wiring and cables and their types and electrical equipment and their specification.
6. Acquire the knowledge of safety precautions in handling electrical appliances, importance of grounding and methods of earthing.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	-	-	-	-	-	-	-	-	-	-	-
2	2	3	1	-	-	-	-	-	-	-	-	-	-	-
3	2	2	1	-	-	-	-	-	-	-	-	-	-	-
4	2	2	1	-	-	-	-	-	-	-	-	-	-	-
5	2	2	1	-	-	-	-	-	-	-	-	-	-	-
6	2	2	1	-	-	-	-	-	-	-	-	-	-	-

UNIT-I DC Circuits
Current, voltage, power and energy, sources of electrical energy, independent and dependent sources, source COnversion, circuit elements, Resistor, Inductor, Capacitor Ohm's law, Kirchhoff's laws, analysis of series, parallel and series-parallel circuits, star-delta Conversion, Node and Mesh analysis (with independent sources only).

UNIT-II : Electromagnetism & AC Circuits Electric charge, electric field, lines of force, electric field intensity, electric flux and flux density, Faraday's laws of electromagnetic induction, static and dynamically induced EMF.
A.C. Circuits: Generation of alternating voltage and current, equation of alternating voltage and current, average and rms values of sinusoidal quantities, form and peak factors, phasor representation of sinusoidal quantities, AC through pure resistance pure Inductance, pure capacitance, RL,RC,RLC circuits.

UNIT-III: Batteries and Fuel Cell
Introduction to batteries, simple cell, EMF and internal resistance of a cell, primary and secondary cells, cell capacity, types and specifications of batteries, charging and discharging of battery, safe disposal of batteries; fuel cell, principle and types of fuel cell, different sources of renewable energy.

UNIT-IV: Electrical Wiring
Types of wires and cables, types of Connectors and switches, system of wiring, domestic and industrial wiring, simple Control circuit in domestic installation, electrical equipment and their specifications

UNIT-V: **Safety & Protection**
Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, other electrics hazards, safety rules, importance of grounding and earthing of electrical equipment, methods of earthing, circuit protection devices: Fuses, MCB, ELCB and Relays.

Text Books:

1. Edward Hughes, "Electrical and Electronics Technology", 10th Edition, Peasson Publishers 2010.
2. V.K. Mehta & Rohit Mehta, "Principles of Electrical Engineering", S.Chand COmpany Limited 2008
3. B.L. Theraja & A.K. Theraja, "Electrical Technology", Vol.I, S.Chand COmpany Limited 2008.

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Suggested Reading:

1. P.V.Prasad & S. Siva Nagraju, “Electrical Engineering: Concepts & Applications”, Cengage Learning, 2012.
2. S. Rao, “Electrical Safety, fire safety engineering & Safety Management”, Khanna publications, 1998.
3. Surjit singh & Ravi Deep Singh, “Electrical Estimating and Costing”, Dhanapath Rai & CO., 1997.

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16CE C01

ENGINEERING MECHANICS

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives: During this Course, students should develop the ability to:

1. Work Comfortably with basic engineering mechanics Concepts required for analyzing static structures
2. Identify an appropriate structural system to study a given problem and isolate it from its environment.
3. Analyze and model the problem using free-body diagrams and equilibrium equations
4. Apply pertinent principles to the system to solve and analyze the problems subjected to frictional forces.
5. Understand the meaning of centroid/ centers of gravity and moments of Inertia using integration methods.
6. Communicate the solution to all problems in an organized and Coherent manner and elucidate the meaning of the solution in the Context of the problem.

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

1. Solve problems dealing with forces in planar force systems
2. Draw free body diagrams to analyze the forces in the given structure
3. Understand the Concept of moments and Couples in plane systems.
4. Understand the mechanism of friction and can solve friction problems
5. Determine the centroid of plane areas and centers of gravity of bodies using integration methods
6. Determine moments of inertia, product of inertia for all areas and mass moments of inertia for bodies,

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	-	1	-	-
2	3	2	-	-	-	-	-	-	-	-	-	1	-	-
3	3	2	-	-	-	-	-	-	-	-	-	1	-	-
4	3	2	-	-	-	-	-	-	-	-	-	1	-	-
5	3	2	-	-	-	-	-	-	-	-	-	1	-	-
6	3	2	-	-	-	-	-	-	-	-	-	1	-	-

Unit - I

Force Systems: Resolution of Coplanar and non-Coplanar force systems (both Concurrent and non-Concurrent), Determining the resultant of planar force systems. Moment of force and its applications and Couples

Unit – II

Equilibrium of force system: Free body diagrams, equations of equilibrium of planar force systems and its applications. Problems on general case of force systems

Unit – III

Theory of friction: Introduction, types of friction, laws of friction, application of friction to a single body & COnnecting systems. Wedge and belt friction

Unit – IV

Centroid: Significance of centroid, moment of area, centroid of line elements, plane areas, Composite areas, theorems of Pappus & its applications. Center of gravity for elementary and Composite bodies

Unit – V

Moment of Inertia: Definition of MI, Polar Moment of Inertia, radius of gyration, transfer theorem, moment of Inertia of elementary & Composite areas, product of inertia. Mass moments of inertia for elementary and Composite bodies

Text Books:

1. K. Vijay Kumar Reddy and J. Suresh Kumar, Singer's Engineering Mechanics, BS Publications, Hyderabad, 2011.
2. Ferdinand L Singer, Engineering Mechanics, Harper and COllins, Singapore, 1904.

Suggested Reading:

1. A. Nelson, Engineering Mechanics, Tata McGraw Hill, New Delhi, 2010.

2. S. Rajashekaran & G. Sankarasubramanyam, Engineering Mechanics, Vikas publications, Hyderabad, 2002.
3. S.B. Junarkar and H.J Shah, Applied Mechanics, Charotar publishers, New Delhi, 2001.
4. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press, New Delhi, 2008.
5 A K Tayal, Engineering Mechanics, Umesh Publications, New Delhi, 2010

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16EG C01

PROFESSIONAL COMMUNICATION IN ENGLISH

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To enable the students to understand the role and importance of Communication and to develop their basic Communication skills in English.
2. To strengthen the students' usage of grammar and to develop their vocabulary.
3. To improve the students' listening skills and introduce them to different reading strategies.
4. To equip the students with appropriate writing skills.
5. To enhance imaginative and critical thinking through literary texts and book review.

Course Outcomes: The students will

1. Understand the nature, process and types of Communication and will Communicate effectively without barriers.
2. Understand the nuances of listening and will learn to make notes
3. Read different texts, Comprehend and draw inferences and Conclusions.
4. Write effective paragraphs, letters and reports
5. Critically analyze texts and write book reviews

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	-	-	-	1	1	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	1	-	-	-	-
4	-	-	-	-	-	-	-	-	-	1	-	-	-	-
5	-	-	-	-	-	-	-	-	-	1	-	-	-	-

UNIT- I Understanding Communication in English: Introduction, nature and importance of Communication. Process of Communication. Basic types of Communication - verbal and non verbal. One way vs. Two way Communication. Barriers to Communication. Intrapersonal and interpersonal Communication. Johari Window.
Grammar & Vocabulary: Parts of speech, figures of speech – Euphemism, Hyperbole, Irony, Metaphor, Onomatopoeia, Oxymoron, Paradox, Personification, Pun & Simile

UNIT- II Developing Listening Skills: Exposure to recorded and structured talks, class room lectures- problems in Comprehension and retention. Types of listening, barriers to listening, effective listening strategies. Note –taking.
Grammar & Vocabulary: Articles, Prepositions, Phrasal verbs, Idioms.

UNIT- III Developing Writing Skills: Sentence structure. Brevity and clarity in writing. Cohesion and Coherence. Paragraph writing. Letter writing - form and structure, style and tone. Kinds of Letters –Apology and request letters. Email etiquette. Report writing.
Grammar & Vocabulary: Tense, Conditionals, homonyms, homophones.

UNIT - IV Developing Reading Skills: The reading process, purpose, different kinds of texts. Reading Comprehension. Techniques of Comprehension – skimming, scanning, drawing inferences and Conclusions. Note-making
Grammar &Vocabulary: Concord, Connectives, Active and Passive voice, Words often Confused.

UNIT- V: Reading for Enrichment

1. The Road Not Taken — Robert Frost
2. Goodbye Party For Miss Pushpa T. S — Nissim Ezekiel
3. The Open Window — Saki
4. The Romance Of A Busy Broker — O. Henry

Book reviews -Oral and written review of a chosen / novel/ play - a brief written analysis including summary and appreciation. Oral presentation of the novel/play
Grammar & Vocabulary: Indianisms, Common errors, Parallelisms.

Text Books:

1. Vibrant English, Orient Blackswan Ltd,

Suggested Reading:

1. M .Ashraf Rizvi, Effective Technical Communication, Tata Mc Graw- Hill, New Delhi
2. Meenakshi Raman and Sangeetha Sharma, Technical Communication - Principles and Practice, Oxford Univ. Press, New Delhi.

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3. Sunil Solomon, English for Success, Oxford University Press, 2015
4. Krishna Mohan, Meera Banerji, Developing Communication Skills, McMillan India Ltd.
5. Michael McCarthy, English Vocabulary in Use.
6. Brikram K Das, Kalyani Samantray, An Introduction to Professional English and Soft Skills Cambridge University Press, New Delhi.

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16CE C02

ENVIRONMENTAL STUDIES

Instruction	1L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	- - -
Credits	1

Course Objectives:

1. To equip the students with inputs on the environment, natural resources and their Conservation.
2. To study the interrelationship between the living organisms and the natural environment and also to enable the students to understand the structure and functioning of the ecosystems.
3. To understand the importance of biodiversity and create awareness on its threats and Conservation strategies.
4. To enable the students become aware of pollution of various environmental segments including their causes, effects and Control measures.
5. To create awareness about environmental legislations in the Context of national Conventions.

Course Outcomes: At the end of the COurse, the student should have learnt

1. To understand the scope and importance of environmental studies, identify the natural resources and ecosystems and Contribute for their Conservation.
2. To understand the ecological services of biodiversity and Contribute for their Conservation.
3. To develop skills to solve the problems of environmental pollution and Contribute for the framing of legislation for protection of environment.
4. To relate the social issues and the environment and Contribute for the sustainable development.
5. To understand the essence of the ethical values of the environment for Conserving depletable resources and pollution Control.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	-	-	-	2	3	-	-	-	-	1	-	-
2	1	-	-	-	-	1	3	-	-	-	-	1	-	-
3	1	-	-	-	-	2	3	1	-	-	-	1	-	-
4	1	-	-	-	-	1	3	1	-	-	-	1	-	-
5	-	-	-	-	-	1	3	2	-	-	-	1	-	-

UNIT – I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Water resources- hydrological cycle, use and over utilization of surface and ground water, floods, drought, Conflicts over water, dams-benefits and problems. Food resources- Changes caused by modern agriculture, fertilizers-pesticide problems, water logging and salinity. Forest resources- use and over exploitation, deforestation. Mineral resources- Use and exploitation, effects of mining. Energy resources- Growing energy needs, various renewable and non-renewable energy sources. Land resources- land as a resource, land degradation- causes and effects, Role of individuals in Conservation of natural resources.

UNIT – II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, Concept of food chains, food webs, ecological pyramids.

UNIT – III

Biodiversity: Types/classification of biodiversity, India as a mega diversity nation, values of biodiversity, threats to biodiversity, Conservation of biodiversity.

UNIT – IV

Environmental Pollution: Cause, effects and COntrol measures of air pollution, water pollution, Soil pollution, Noise pollution and Thermal pollution.

Environmental Legislations: Environment protection act, Air, Water, Forest & Wild life acts.

UNIT – V

Social issues and the environment: Water COnservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development, Population explosion and Climate change: Global warming, Acid rain, Ozone layer depletion.

Text Books:

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1. P. D.Sharma, “Ecology & Environment”, Ashish publications, 1994
2. Y. Anjaneyulu, “Introduction to Environmental Science”, B S Publications, 2004

Suggested Reading:

1. Dr. Suresh K. Dhameja, “Environmental Studies”, S. K. Kataria & Sons, 2009
2. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley, 1991
3. S. S. Dara, “A Text Book of Enviromental Chemistry & Polution COntrol”, S. Chand Limited, 2006

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16ME C02

ENGINEERING GRAPHICS

Instruction	1L + 3D Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To provide an exposure in understanding the drawings during a multidisciplinary approach towards a problem
2. To train up in perception and imagination of a three dimensional scenario.

Course Outcomes:

1. Use of various drawing instruments, grades of pencils. Different types of lines, letters, number, Geometric constructions
2. Draw Ellipse, Parabola, Hyperbola, cycloidal and involute curves by various methods
3. Draw orthographic projections of points, Straight lines inclined to one and both the reference planes
4. Draw projection of perpendicular planes and oblique planes
5. Draw projection of solids inclined to one plane and parallel to another reference plane and section of solids in simple position
6. Use basic drawing and editing commands using graphic packages

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	-	-	1	-	-	-	1	1	-	1	-	1
2	3	1	-	-	2	-	-	-	1	2	1	2	1	2
3	2	1	-	-	1	-	-	-	1	2	1	1	-	2
4	2	1	-	-	2	-	-	-	1	2	1	1	-	2
5	3	1	-	-	2	-	-	-	1	2	1	2	1	2
6	1	1	-	-	2	-	-	-	1	2	1	2	2	2

UNIT – I

Introduction to Engineering Drawing: Drawing Instruments and their uses, types of lines, use of pencils, Lettering, Rules of dimensioning

Conic Sections: Ellipse, Parabola, Hyperbola including the Rectangular Hyperbola (General method only)

Cycloidal curves: Construction of cycloid, epi-cycloid, hypo-cycloid & involutes

UNIT – II

Orthographic Projections: Principles of Orthographic Projections – Conventions , Projection of Points, Projection of Lines - inclined to both planes.

UNIT – III

Projections of Planes: Projections of regular Planes – Perpendicular planes and Oblique planes.

UNIT – IV

Projections of Solids: Projections of Regular Solids – Regular Polyhedra, solids of revolution, (Simple position only)

Sections of Solids: Types of cutting planes – their representation – sections of solids in simple position.

UNIT – V

Introduction to Graphic packages: Getting started, Basic drawing and editing COmmands, creating lines, planes and solids.

Note: Syllabus for external examination will be from unit 1 to unit 4 only & unit-5 is exempted from external examination. Unit 5 is for internal examination only.

Text Books:

1. N.D.Bhatt,” Elementary Engineering Drawing”, Charotar Publishers, 2012
2. Basanth Agrawal and C M Agrawal “Engineering Drawing 2e “, McGraw-Hill Education(India) Pvt. Ltd.

Suggested Reading:

1. K.L.Narayana and P.K.Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011
2. P.S.Gill’ “Engineering Graphics”, Kataria Publications, 2011
3. K.Veenugopal, “Engineering Drawing and Graphics + Autocad”, New Age International Pvt. Ltd, 2011
4. Shaw M.B and Rana B.C., “Engineering drawing”, Pearson, 2nd edition, 2009
5. P I Varghees, “ Engineering Graphics “,Tata McGraw-Hill publications, 2013
6. Bhattacharya. B, “Engineering Graphics”, I. K. International Pvt. Ltd, 2009
7. Dhawan R.K., “Principles of Engineering Graphics and Drawing”, S. Chand, 2011

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16PY C03

ENGINEERING PHYSICS LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives: The objectives of the Course is to make the student
1. Apply theoretical physics knowledge in doing experiments
2. Understand the behavior of the light experimentally
3. Analyze the behavior of magnetic and dielectric materials

Course Outcomes: At the end of the Course, the student will be able to
1. Understand the Concept of errors and find the ways to minimize the errors
2. Demonstrate interference and diffraction phenomena experimentally
3. Distinguish between polarized and unpolarized light
4. Determine the loss of energy of a ferromagnetic material and its uses in electrical engineering
5. Understand the suitability of dielectric materials in engineering applications

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	1	1	1	1	1	1	1	1	1	-	-
2	1	1	2	1	1	1	1	1	1	1	1	1	-	-
3	2	1	1	1	1	2	2	1	1	1	1	1	-	-
4	2	1	1	1	1	2	2	1	1	1	1	1	-	-
5	2	1	1	1	1	1	2	1	1	1	1	1	-	-

List of 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 mercury light
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. B-H Curve – Determination of hysteresis loss of given specimen
9. Dielectric Constant – Determination of dielectric Constant of given PZT sample
10. Ultrasonic Interferometer – Determination of velocity of ultrasonics in given liquid

Note: A student must perform a minimum of eight experiments.

Suggested Reading:

1. "Engineering Physics" - Manual by Department of Physics, CBIT, 2016
2. S.K. Gupta, "Engineering Physics Practical", Krishna's Educational Publishers, 2014
3. O.P. Singh, V. Kumar and R.P. Singh, "Engineering Physics Practical Manual", Ram Prasad & Sons Publications, 2009

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16CY C04

APPLIED CHEMISTRY LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives:

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory
2. For practical understanding of theoretical Concept of chemistry.
3. The student should be Conversant with the principles water characterization and treatment of potable and industrial purposes.

Course Outcomes:

1. Identify the basic chemical methods to analyze the substances quantitatively.
2. Determine the hardness of water for both domestic & industrial purpose
3. Identify the amount of alkalinity present in various water samples.
4. Calculate the amount of Strong & weak acids by Conduct metric methods.
5. Estimate the chemical Compounds using their potentials by instrumental methods

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	2	-	2	2	1	-	-	-	2	-	1
2	3	2	2	1	-	2	2	1	-	-	-	2	-	1
3	3	2	2	2	1	2	2	1	-	-	-	2	-	1
4	3	2	2	2	2	2	2	1	-	-	-	2	-	1
5	3	2	2	2	2	2	2	1	-	-	-	2	-	1

LIST OF EXPERIMENTS

1. Introduction to chemical analysis
2. Preparation of standard solution of oxalic acid and Standardization of NaOH
3. Estimation of amount of oxalic acid in the given solution using Mohr's salt and $KMnO_4$
4. Estimation of total hardness of water using EDTA solution
5. Estimation of temporary hardness and permanent hardness of water using EDTA solution
6. Estimation of amount of carbonate in the given solution using HCl link solution
7. Estimation of amount of carbonate and bicarbonate in the given solution using HCl link solution
8. Estimation of amount of HCl conductometerically using NaOH solution
9. Estimation of amount of CH_3COOH conductometerically using NaOH solution
10. Estimation of amount of HCl and CH_3COOH present in the mixture of acids conductometerically using NaOH solution
11. Estimation of amount of HCl potentiometrically using NaOH solution
12. Estimation of amount of Fe^{+2} potentiometrically using $KMnO_4$ solution

Suggested Reading:

1. Applied Chemistry: Theory and Practice (Latest ed.), By O.P. Vermani & A.K. Narula
2. Vogel's Textbook of Quantitative Chemical Analysis (Latest ed.), Revised by G.H. Jeffery, J. Bassett, J. Mendham & R.C. Denney
3. Instrumental methods of Chemical Analysis, MERITT & WILLARD East-West Press

16EG C02

PROFESSIONAL COMMUNICATION LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

COurse Objectives:

1. To introduce students to phonetics and the different sounds in English.
2. To familiarize the students with the software and give them sufficient practice in correct pronunciation.
3. To enable students to speak English correctly with focus on stress and intonation.
4. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
5. To understand team work, role behavior and to develop the ability to analyze, evaluate, Construct and refute arguments.

Course Outcomes:

1. The students will understand the speech sounds in English and the nuances of pronunciation.
2. The students will understand tone, intonation and rhythm and apply stress Correctly.
3. The students will be able to participate in group discussions with clarity and Confidence.
4. The students will speak COnfidently on stage with appropriate body language.
5. The students will debate on various issues and learn to work in teams.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	1	-	-	-	-
4	-	-	-	-	-	-	-	-	-	1	-	-	-	-
5	-	-	-	-	-	-	-	-	-	1	1	-	-	-

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. **Aspects of Connected speech**: Strong forms, weak forms, Contracted forms, elision.
4. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
5. **Rhythm & Intonation**: Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
6. **Listening skills** – practice with IELTS and TOEFL material
7. **Situational dialogues and role play**
8. **Public speaking** is to be shown by incorporating narrative examples and extracts from speeches.
9. **Group Discussions**– videos to be shown and practice sessions
10. **Poster making** – preparation and presentation
11. **Debate** - Differences between a debate and a group discussion. Essentials of a debate, Conducting a debate.

Suggested Reading:

1. E Suresh kumar et al, . English for Success (with CD), Cambridge University Press India Pvt Ltd. 2010.
2. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016
3. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
4. J Sethi et al. A Practical COurse in English Pronunciation (with CD), Prentice Hall India, 2005.
5. Edgar Thorpe. Winning at Interviews, Pearson Education, 2006
6. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd 2011

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION
II-Semester of B.E under CBCS
COMPUTER SCIENCE AND ENGINEERING
B.E (CSE, ECE and IT)

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	16MT C02	Engineering Mathematics - II	3*	0	3	30	70	3
2	16CY C01	Engineering Chemistry	3	0	3	30	70	3
3	16PY C02	Applied Physics	2	0	3	30	70	2
4	16CS C01	Programming and Problem Solving	3/1	0	3	30	70	4
5	16ME C01	Elements of Mechanical Engineering	3	0	3	30	70	3
6	16EC C01	Elements of Electronics and Communication Engineering	3	0	3	30	70	3
7	16CE C03	Professional Ethics and Human Values	1	0	3	30	70	1
PRACTICALS								
8	16CS C02	Programming Laboratory	-	2	3	25	50	1
9	16ME C03	Mechanical and IT Workshop	-	3	3	25	50	2
10	16PY C04	Applied Physics Laboratory	-	2	3	25	50	1
11	16CY C03	Engineering Chemistry Laboratory	-	2	3	25	50	1
TOTAL			**18/1**	**09**	**-**	**255**	**570**	**24**

L - Lecture (clock hours) T - Tutorial (clock hours) P/D - Practical / Drawing (clock hours)

* One extra hour may be permitted in the timetable

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16 MT C02

ENGINEERING MATHEMATICS – II

Instruction	3L Periods per week + 1 (extra hour)
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To know the relevant methods to solve higher order differential equations.
2. To learn the Laplace and Inverse Laplace transforms for solving engineering problems.
3. To know improper integrals such as Beta, Gamma functions.
4. To learn Vector Differential Operator and its physical interpretations.
5. To evaluate vector line, surface & volume integrals.
6. Learn to apply all the above mathematical methods/techniques to interpret the results in physical and technical terms.

Course Outcomes:

1. Solve the solutions of Differential Equations which arise in electrical circuits, vibrations and other linear systems.
2. Able to solve solutions of differential equations with initial and boundary value problems.
3. Evaluating definite integrals using Beta, Gamma functions.
4. Understating the significance of gradient, divergent and Curl.
5. Use Greens, Gauss and Stoke"s theorems to find the surface and volume integrals.
6. Able to solve and analyse the Engineering problems.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	-	1		-	-	-	-	1	1	-	-
2	2	2	1	-	-	-	-	-	-	-	1	1	-	-
3	2	2	1	-	1	-	-	-	-	-	1	1	-	-
4	2	2	1	-	1	-	-	-	-	-	1	1	-	-
5	3	2	1	-	-	-	-	-	-	-	1	1	-	-
6	3	2	1	--	1			-	-	-	1	1	-	-

UNIT-I Ordinary differential Equations: Linear Differential equations of higher order with Constant Coefficients, Complementary function and particular integrals when RHS is of the forms e^{ax} , sin ax , COs ax , x^m , $e^{ax}\,v$, $x^m\,v$,where v-is a function of x, Cauchy"s equation, electrical circuits of second order

UNIT-II Laplace Transforms: Laplace transforms of standard functions, Laplace transforms of piecewise COntinuous functions, first shifting theorem, multiplication by „t", division by „t". Laplace transforms of derivatives and integrals of functions-Unit step function- Periodic functions (without proofs). Inverse Laplace transforms-by partial fractions (Heaviside method), COnvolution Theorem, Solving Ordinary differential equations by Laplace Transforms

UNIT-III Beta and Gamma Functions: Definitions of Beta and Gamma functions-elementary Properties of both Beta and Gamma functions, Relation between Beta and gamma functions, differentiation under the integral sign.

UNIT-IV Vector Differentiation: Scalar and vector fields- directional derivative- Gradient of a scalar-Divergence and Curl of a vector point function. Properties of divergence, curl, Solenoidal and Irrotational vectors

UNIT-V Vector Integration: Evaluation of Vector Line integrals, surface integrals and volume integrals, Greens, Gauss divergence and Stokes theorems (without proofs) and its applications

Text Books:

1. Erwin Kreyszig "Advanced Engineering Mathematics,"10th edition, John Wiley & Sons -Publishers.
2. R.K.Jain & S.R.K.Iyenger "Advanced Engineering Mathematics" , 3rd edition, Narosa Publications
3. Alen Jaffery "Mathematics for Engineers & Scientists" , 6thed 2013 CRC press, Taylor & Francis Group. (Elsevier)
4. Dr.B.S.Grewal "Higher Engineering Mathematics", 43rd edition, Khanna Publishers.

Suggested Reading: (for further reading and examples on applications)

1. A.Craft and Robert Davison "Mathematics for Engineers-a modern interactive approach" -Willey
2. Loius Pipes "Applied Mathematics and physicists" Mc Graw Hill publishers.
3. Kanti.B.Datta "Mathematical Methods of Science & Engg," Aided with MATLAB,. Cengage Learning India Pvt.Ltd.
4. AR COllar and A. Simpson "Matrices for Engineering Dynamics" -John Willey & sons.

Professor and Head Department

16CY C01

ENGINEERING CHEMISTRY

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

The syllabus has sought to fulfil the objective of making the student of engineering and technology realize that chemistry is the real base of his profession and that therefore he must have a good understanding of chemistry before he can use it in his profession.

“ the study of chemistry is profitable not only in as much as it promotes the material interest of mankind ,but also because it furnishes us with insight into the wonders of creation , which immediately surround us and with which our existence, life and development, are most closely Connected.” Justus Von Leibig (German Chemist)

The various units of the syllabus is so designed to fulfil the following objectives.

1. This syllabus helps at providing the necessary introduction of the chemical principles involved and devices in a Comprehensive manner understandable to the students aspiring to become practicing engineers.
2. The aim of framing the syllabus is to impart intensive and extensive knowledge of the subject so that students can understand the role of chemistry in the field of engineering.
3. Thermodynamics and Electrochemistry units give Conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. Fuels have been taught with a view to give awareness as to materials which can be used as sources of energy
5. To understand importance of analytical instrumentation for different chemical analysis.

Course Outcomes:

1. Identify the spontaneous and non-spontaneous processes
2. Describe the Concepts in the separation of metals from mixture of metals
3. Classify the Conventional sources of energy and their importance.
4. Explain the Concepts of electrochemistry to produce electrical energy
5. Illustrate the various instrumental methods to analyze the chemical Compounds
6. Discuss the principles of Green Chemistry

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	2	1	2	2	1	-	-	-	2	-	1
2	3	2	1	1	1	2	2	1	-	-	-	2	-	1
3	3	2	2	2	2	2	2	1	-	-	-	2	-	1
4	3	2	2	2	1	2	2	1	-	-	-	2	-	1
5	3	2	2	2	3	2	2	1	-	-	-	2	-	1
6	3	2	3	2	2	1	2	1	-	-	-	2	-	1

UNIT – I

Chemical Thermodynamics: Introduction and definition of the terms, the COncept of reversible and irreversible processes, Work done in isothermal and adiabatic processes, Success and limitations of First law of thermodynamics, need for seCOnd law of thermodynamics, statements of seCOnd law of thermodynamics, Carnot cycle, heat engine and its efficiency, Carnot theorem, COncept of Entropy - Entropy changes in reversible and irreversible processes, physical significance of entropy criteria of spontaneity in terms of entropy and Gibb"s free energy function , Gibb"s-Helmholtz equation and applications, Numericals.

UNIT – II

Phase rule & Chemical Equilibria

Phase rule : Statement , definition of the terms - phases, Components , degrees of freedom with examples, Phase diagram - one Component system (water system), two Component system (siver-lead system) , desilverisation of lead.

Chemical Equilibria - Homogenous and Heterogenous Equilibria - applications

UNIT – III

Fuels: Classification, requirements of a good fuel, calorific value, types of calorific value, calculation of CV using Dulong"s formula, Combustion - calculation of air quantities by weight and volume, Numericals.

Solid fuels: COal - analysis of COal – proximate and ultimate analysis - importance.

Liquid fuels - crude oil - fractional distillation, cracking - Fixed bed catalytic cracking, knocking, antiknocking agents (TEL, MTBE), octane number, cetane number, unleaded petrol.

Gaseous fuels - LPG, CNG - Composition and uses

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UNIT – IV

Electrochemistry Introduction, Construction of electrochemical cell, sign Convention, cell notation, cell emf, SOP and SRP, electrochemical series and its applications, Nernst equation and applications, Types of Electrodes - Standard Hydrogen Electrode, Saturated Calomel Electrode, Quinhydrone electrode and Ion selective electrode (Glass electrode), Construction, Numericals

UNIT –V

Instrumental Techniques in Chemical Analysis: Principle, method and applications of COnductometry (acid-base titration), Potentiometry (acid-base, redox titration), pH- metry (acid – base titration), COlorimetry (Beer Lambert‟s law)

Green Chemistry - outlines and Principles

Text Books:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Pub, CO., New Delhi (2002)
2. Puri & Sharma, "Principles of Physical Chemistry
3. S.S.Dara & S.S.Umare, "Engineering Chemistry", S.Chand COmpany
4. J.C. Kuriacase & J. Rajaram, "Chemistry in engineering and Technology", Tata McGraw-Hill Pub.CO.Ltd, New Delhi (2008).
5. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.CO.Ltd, New Delhi (2008).
6. P.R.Vijayasarathi, "Engineering Chemistry" PHI Learning Private Limited, New Delhi (2011)

Suggested Reading:

1. Physical chemistry by P.W.Atkin (ELBS OXFORD PRESS)
2. Physical chemistry by W.J.Moore (Orient Longman)
3. Physical Chemistry by Glasstone
4. Physical Chemistry by T.Engel & Philip Reid, Pearson Publication.
5. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd.,Meerut (2001).

16PY C02

APPLIED PHYSICS

Instruction	2L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	20 Marks
Credits	2

Course Objectives: The objectives of the Course is to make the student
1. Learn the Concepts of modern physics
2. Gain knowledge of wave mechanics and statistical mechanics
3. Know the different kinds of materials and their characterization techniques

Course Outcomes: At the end of the Course, the student will be able to
1. Understand the advances in laser physics, holography, optical fibers and apply them in engineering & technology
2. Explain the importance of wave mechanics and band theory of solids
3. Analyze and apply distributions of statistical mechanics for problem solving
4. Identify the materials with semiconducting and superconducting properties for engineering applications
5. Understand the role of novel materials and their characterization techniques in engineering and technology

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	1	1	1	-	-	-	1	1	1	-	-
2	3	3	1	1	1	1	-	1	-	1	1	1	-	-
3	3	3	2	-	1	1	1	1	1	1	-	1	-	-
4	3	3	1	1	1	1	1	-	1	1	1	1	-	-
5	3	3	1	1	1	1	1	-	1	1	1	1	-	-

UNIT – I Lasers & Holography: Characteristics of lasers – Spontaneous & stimulated emission of radiation – Einstein"s Coefficients – Population inversion – Lasing action – He-Ne laser – Semiconductor laser – Applications. Basic principle of Holography – Recording & Reconstruction of hologram – Applications
Optical Fibers: Principle and Construction – Propagation of light through an optical fibre – Acceptance angle – Numerical aperture – Pulse dispersion – Classification of optical fibers: Single mode & Multi mode and Step-index & Graded-index optical fibers – Double crucible method – Applications.

UNIT – II Wave Mechanics: Schrödinger time independent and time dependent wave equations – Physical significance of wave function – Infinite square well potential (particle in a box) – Potential barrier – Tunneling effect .
Band Theory of Solids: Origin of energy band formation – Electron in periodic potential – Kronig-Penny model (qualitative) – Classification of solids

UNIT – III Elements of Statistical Mechanics: Maxwell-Boltzmann statistics – Bose-Einstein statistics – Fermi-Dirac statistics – Photon gas – Planck"s" law of black body radiation – Wien"s law and Rayleigh-Jean"s law from Planck"s law – Concept of electron gas (qualitative) – Fermi energy level.

UNIT – IV Semiconductors: Intrinsic and extrinsic semiconductors – Carrier Concentration in intrinsic semiconductors – Energy gap – Hall Effect – Construction & working of solar cell.
Superconductors: General properties of superconductors – Meissner"s effect – Type I and Type II superconductors – BCS theory (qualitative) – Applications.

UNIT – V Nanomaterials: Properties of materials at reduced size – Surface to volume ratio – Quantum Confinement – Preparation of nanomaterials: Bottom-up approach (Sol-gel method) & Top-down approach (Ball milling method) – Elementary ideas of carbon nanotubes – Applications of nanomaterials.
Techniques for Characterization of Materials: X-ray fluorescence – Auger (OJ) process – Scanning electron microscope (SEM) – Tunneling electron microscope (TEM) – Atomic force microscope (AFM).

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 Engineering Physics", S. Chand Publications, 2014.
3. Satya Prakash, "Statistical Mechanics", Kedar Nath Ram Nath Publications, 2008.
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. M. Arumugam, "Materials Science", Anuradha Publications, 2015.
3. P.K. Palanisamy, "Engineering Physics", Scitech Publications, 2012.
4. Hitendra K Malik and A.K. Singh, "Engineering Physics", Tata McGraw Hill Education Publications, 2011

16CS C01

PROGRAMMING AND PROBLEM SOLVING

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

Course Objectives:
1. To acquire problem solving Skills.
2. To be able to write Algorithms.
3. To understand structured programming Approach.
4. To understand Memory structure.
5. To implement I/O Programming.
6. To be able to write program in C Language.

Course Outcomes: Student will be able to:
1. Develop algorithms for scientific problems.
2. Explore algorithmic approaches to problem solving.
3. Understand the Components of Computing systems.
4. Choose data types and structure to solve mathematical problem.
5. Develop modular programs using COntrol structure, arrays and structures.
6. Write programs to solve real world problems using structured features.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	-	1	-	-	-	-	-	-	-	1	1
2	3	3	3	-	1	-	-	-	-	-	-	1	1	1
3	3	1	-	-	1	-	-	-	-	-	-	1	-	-
4	3	2	-	-	1	-	-	-	-	-	-	1	-	-
5	3	3	2	-	1	-	-	-	-	-	-	-	1	1
6	3	3	3	-	1	-	-	-	-	-	-	1	1	1

UNIT – I

Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts.

Introduction to C Language: Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

UNIT – II

Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do-While and Examples. Continue, Break and goto statements.

Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Parameter Passing-Call- by-value, call-by-reference, Recursion.

UNIT – III

Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.

Arrays: Concepts, Using Arrays in C, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays.

Searching and Sorting: Linear and Binary Search, Selection Sort and Bubble Sort.

UNIT – IV

Pointers: Introduction, Pointers to Pointers, Compatibility, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command-line Arguments.

Strings: Concepts, String Input /Output Functions, Arrays of Strings, String Manipulation Functions.

UNIT – V

Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Unions, Type Definition (typedef), Enumerated Types.

Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/output Functions, Character Input/output Functions

Preprocessors: Preprocessor Commands

Text Books:

1. Pradip Dey and Manas Ghosh "Programming in C 2/e" Oxford University Press , 2nd Edition 2011.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language" Prentice Hall India, 2nd Edition 1990.
3. B.A.Forouzan and R.F. Gilberg A Structured Programming Approach in C, Cengage Learning,2007.

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Suggested Reading:

1. Rajaraman V. "The Fundamentals of COmputers" 4th Edition, Prentice Hall of India, 2006.
2. R S Bichker “programming in c” University Press ,2012.

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16ME C01

ELEMENTS OF MECHANICAL ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. Student will understand different types of engineering materials and their applications.
2. Student will Come to know working principles of Petrol & Diesel engines with basic knowledge of thermodynamics.
3. Student will understand various making processes.
4. Student will Come to know various power transmission devices.
5. Student will understand the importance of principles of management in industry.
6. Student will Come to know aspects of various quality COntrol techniques.

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

1. Select the material depending upon requirement.
2. Evaluate performance of Petrol & Diesel engines.
3. Demonstrate his/her knowledge in preparing process chart for various machining operations.
4. Estimate the power required for various power transmitting devices like belt and gear trains.
5. Become a successful entrepreneur after studying principles of management.
6. Apply various quality Control techniques after studying principles of industrial engineering.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	1	1	2	2	1	-	-	2	2	-	-
2	3	2	3	2	1	3	3	1	1	1	1	2	-	-
3	2	2	2	2	2	2	1	1	1	2	1	1	-	-
4	3	2	2	2	1	1	1	1	1	1	1	1	-	-
5	2	1	1	1	1	1	1	2	3	3	2	2	-	-
6	2	2	2	1	2	1	1	1	1	2	2	1	-	-

UNIT – I Engineering Materials: Metals and their alloys, Ductile and brittle materials, Ceramics, Polymers, Composite materials
Simple Stresses & Strains: Stress-strain diagram (for ductile and brittle materials), Poison"s ratio, Young"s Modulus, Rigidity modulus, Bulk modulus, Failure theories, factor of safety.

UNIT – II Thermodynamics: Zeroth, First, Second and Third laws of thermodynamics and Corollaries
I.C. Engines: Working principle of Two stroke and Four stroke SI and CI engines, Calculations of efficiencies
Heat Transfer: Fourier law of Conduction in single Coordinates, Newton's law of Conduction, Stephens & Boltzmann law of radiation

UNIT – III Basic Manufacturing Processes: Introduction to Welding, Brazing & Soldering, Principles of gas welding & arc welding processes, Casting, Principles of sand casting and die casting, Principles of Turning, Drilling, Milling, Grinding, Knurling, Tapping and Honing operations

UNIT – IV Kinematics: Definitions of kinematic link, pair, mechanism and machine
Gear Trains: Simple, Compound, Inverted and Epicyclic gear trains
Belt Drives: Open and crossed belt drives, length of belts, ratio of belt tensions for flat belt, Condition for maximum power transmission for flat belt
Fluid Mechanics: Definition and basic properties of fluids, types of fluids and fluid flows, stream lines, streak lines, stream function and velocity potential

UNIT – V Industrial Engineering & Management: Introduction to scientific management, basics and importance of work study, steps in Conducting work study, time study, standard time, organization and types of organization, Quality definition and its importance, introduction to quality Control, types of inspection.

Text Books:

1. Jonathan Wickert and Kemper E. Lewis, An Introduction to Mechanical Engineering,3rd Ed, Cengage learning, USA, 2013
2. Yunus A. Cengel, Heat Transfer: A Practical Approach, Mcgraw-Hill, 2nd edition, 2002
3. Mahesh M Rathore, Thermal Engineering, Tata Mc Grw Hill Eduation Pvt. Ltd., 2010

Suggested Reading:

1. R K Rajput, Thermal Engineering, Laxmi Publications, 2010
2. Michael Geoffrey Stevenson, Industrial Engineering, University of N.S.W., Division of Postgraduate Extension Studies, 1972
3. PN Rao, Manufacturing Technology, Volume-I, 3rd Edition, Tata McGraw-Hill, Education, 2009
4. Thomas Bevan, Theory of Machines, 3rd Edition, Pearson Education India, 1986
5. P. N. Modi, S. M. Seth, Hydraulics and Fluid Mechanics: Including Hydraulic Machines, Standard Book House, 2011

16EC C01

ELEMENTS OF ELECTRONICS AND COMMUNICATION ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. To understand the elementary Concepts of electronic devices.
2. To study basics of Boolean algebra and working of digital circuits.
3. To understand basic operations of AM, FM, filters and multiplexing .
4. To enable the students to understand the working of Commonly used Communication systems.
5. To give an exposure to the selected applications.

Course Outcomes: The students will be able to
1. Familiar with the basic electronic devices and simple circuits
2. Work with Boolean algebra principles, build the simple COmbinational and sequential circuits
3. Appreciate the need for modulation, filtering and multiplexing
4. Understand the working principles of a few Communication systems
5. Familiar to the selected applications

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	-	-	-	-	-	-	-	-	-	1	-
2	2	3	1	-	-	-	-	-	-	-	-	-	1	-
3	2	2	1	-	-	-	-	-	-	-	-	-	-	1
4	2	2	1	-	-	-	-	-	-	-	-	-	1	1
5	2	2	1	-	-	-	-	-	-	-	-	-	-	2

UNIT – I
Basics of Passive and Active Devices
Classification of passive and active devices and their symbols; current flow in a semiconductor; Operating principle of a diode, its application as a rectifier; Operating principle of a transistor (BJT and JFET), Principle and use of Zener diode, Photo diode and LED.

UNIT-II
Introduction to Digital Electronics
Number systems, Binary addition and subtraction, ASCII Code, Boolean algebra (Theorems and properties), Logic gates, Combinational circuits such as Half adder, Full adder and Half subtractor, Introduction to sequential logic, Basic Flip flop, Evolution of ICs, block diagram description of Microprocessor and Microcontroller.

UNIT – III
Principles of Communication Engineering (Elementary treatment only)
Basic Communication system Components; Concept of Modulation, Introduction to AM, FM and Comparisons; Introduction to wired and wireless Communication; Concepts of filtering, LPF, HPF, BPF and BSF; Concept of multiplexing, TDM and FDM.

UNIT-IV
Overview of Communication Systems
Radio spectrum and applications, Modes of propagation;
Basic cellular network and Concepts of a cell, frequency reuse, hand-off and cross-talk;
Basic Radar block diagram and applications; Introduction to Communication satellite, Geostationary satellites and subsystems, Applications of satellites, GPS, DTH, Remote Sensing;

UNIT –V
Basic operating principles of selected applications:
Block diagram of CRO and application; Software Defined Radio (SDR)-Definition and it‟s block diagram; Smart phone-features; Introduction to Wireless sensor networks (Bluetooth and ZigBee), RFID-and its types, basic functions; Introduction to Modem.

Text Books:

1. "Electronic Principles" by Albert Malvino and David J Bates, 7th Edition, 2006
2. "Digital Priniciples and Applications", by Donald P Leach, Albert Paul Malvino, Gautham saha, Tata McGraw Hill,6th Edition,2009
3. "Electronic COmmunication Systems", by Kennedy and Davis, Tata Megra Hill Publications, 4th Edition, 2008

16CE C03

PROFESSIONAL ETHICS AND HUMAN VALUES

Instruction	1L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	- - -
Credits	1

Course Objectives:

1. To develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. To enable the students, understand the values, the need for value adoption and prepare them meet the challenges
3. To enable the students, develop the potential to adopt values, develop a good character and personality and lead a happy life
4. To motivate the students, practice the values in life and Contribute for the society around them and for the development of the institutions /organisation around they are in.
5. To make the students understand the professional ethics and their applications to engineering profession

Course Outcomes:

1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, Convert everything into happiness and Contribute for the happiness of others.
4. Students become potential sources for Contributing to the development of the society around them and institutions/ organizations they work in.
5. Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	1	2	3	-	-	-	-	-	-
2	-	-	-	-	-	2	1	3	-	-	-	-	-	-
3	-	-	-	-	-	2			-	-	-	-	-	-
4	-	-	-	-	-	3	2	1	-	-	-	-	-	-
5	-	-	-	-	-	2	3	3	-	-	-	-	-	-

UNIT-I Concepts and Classification of Values –Need and challenges for value Adoption -Definition of Values – COncept of Values
– Classification of Values – Hierarchy of Values – Types of Values – Interdependence of Values
Need for value education – Lack of education in values – Benefits of value education- Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges

UNIT – II: Personal Development and Values in Life
Personal Development: – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity - Integrating values in everyday life

UNIT – III: Practicing Values for the development of Society
Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atrocities – Working for the Sustainable development of the society
Principles of Integrity-Institutional Development - Vision for better India.

UNIT – IV: Basic Concepts of Professional Ethics
Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional Ethics, Ethical dilemmas, Science – Religion - Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities like Sri.M.Visweshwarayya, Dr.APJ Abdul Kalam and JRD Tata

UNIT-V: Ethics in Engineering Profession
Engineering Profession-Technology and Society- Ethical obligations of Engineering Professionals-Role and responsibility of Engineers - A few Case Studies on Risk management safety and Risk Management
Plagiarism-Self plagiarism- -Ethics Standards and Bench Marking

Text Books:

1. Subramanian R, “ Professional Ethics “ , Oxford University Press , 2013
2. Nagarajan R S, “ A Text Book on Human Values and Professional Ethics “ New Age Publications , 2007
3. Dinesh Babu S, “ Professional Ethics and Human Values “ , Laxmi Publications , 2007

Suggested Reading:

1. SantoshAjmera and Nanda Kishore Reddy , “Ethics , Integrity and Aptitude”,McGrawhill Education Private Limited, 2014
2. Govinda Rajan M, Natarajan S, Senthil Kumar V S,“Professional Ethics and Human Values”, Prentice Hall India, Private Limited,2012
3. COurse Material for Post Graduate Diploma In “Value Education & Spirituality” Prepared by Annamalai University in COllaboration with Brahma Kumaris, 2010

16CS C02

PROGRAMMING LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

1. Demonstration of Control structures.
2. Demonstration of switch case (menu driven).
3. Demonstration of Parameter passing Methods.
4. Demonstration of Functions using Recursion.
5. Demonstration of arrays Operations on Matrix.
6. Implementation of bubble sort.
7. Implementation of selection sort.
8. Implementation of Linear and Binary Search.
9. Implementation of string manipulation operations with and without library function.
10. Demonstration using Pointers.
11. Demonstration of Array of Structures.
12. Sequential file operations.

Course Outcomes:

1. Identify and setup Integrated Development Environment for program development
2. Apply C language constructs to solve mathematical and scientific calculation
3. Debug C programs using modern tools
4. Represent data as arrays, pointer, structures and manipulate
5. Design and develop modular programs using functions for solving complex problems
6. Develop applications using file

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	--	--	--	3	--	--	--	--	--	--	--	2	3
2	3	3	2	--	1	--	--	--	--	--	--	--	--	--
3	--	--	3	--	3	--	--	--	--	--	--	--	--	2
4	2	2	--	3	--	--	--	--	--	--	--	--	--	--
5	--	--	3	2	--	--	--	--	--	--	--	--	1	--
6	--	--	3	2	--	--	--	--	--	--	--	--	--	1

Text Books:

1. Pradip Dey and Manas Ghosh “Programming in C 2/e” Oxford University Press , 2nd Edition 2011.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language” Prentice Hall India, 2nd Edition. 1990.

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16ME C03

MECHANICAL AND IT WORKSHOP

Instruction	3P Periods per week
Duration of End Examination	3 Hours
End Examination	50 Marks
Sessional	25 Marks
Credits	2

Mechanical Workshop

Trades for Practice 1. Fitting 2. Tin Smithy 3. Carpentry 4. House Wiring Exercises in Fitting

1. To make a perfect rectangular MS flat
2. To do parallel cuts using Hack saw
3. To drill a hole and tap it
4. To make male and female fitting using MS flats-Assembly1
5. To make male and female fitting using MS flats-Assembly2

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	1	1	-	1	2	1		1	-	-
2	1	-	-	-	1	1	-		1			2	-	-
3	1	-	-	-	1	1	-	1	2	1		1	-	-
4	1	-	-	-	1	2	-		1	1	1	1	-	-
5	1	-	-	-	2	1	-		1	1	1	1	-	-

Exercises in Tin smithy

1. To make a square tray from the given sheet metal.
2. To make a rectangular box from the given sheet metal with base and top open. Solder the COrners.
3. To make a scoop.
4. To make a dust pan from the given sheet metal.
5. To make a pamphlet box.

Exercises in Carpentry

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

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 bell push.
2. Wiring of two light points Connected in series and Controlled by single pole switch. Verify the above circuit with different bulbs.
3. Wiring of two light points Connected in parallel from two single pole switches and a three pin socket
4. Stair case wiring-wiring of one light point Controlled from two different places independently using two 2-way switches.
5. Go-down wiring.

Demonstration of plumbing and welding trades

Note: ***A minimum of 12 exercises from the above need to be done***

Suggested Reading:

1. Workshop Technology -- Hazra chowdary

IT Workshop

List of Tasks:

Task 1: MS Word: Formatting text, inserting images, tables, equations and hyperlinks
Document Management: Page layout techniques and printing

Task 2: MS Excel: Functions and formulas and graph plotting

Task 3: MS Power point presentation: Guidelines for effective presentation, inserting objects, charts, hyperlinks and navigation between slides

Task 4: Essentials Search Engines & Net etiquette, Plagiarism, Open source tools and other utility tools

Suggested Reading:

1. SCOtt Mueller"s Upgrading and Repairing PCs, 18/e, SCOtt. Mueller, QUE, Pearson, 2008.
2. The Complete Computer upgrade and repair book, 3/e, Cheryl A Schmidt, Dreamtech

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16PY C04

APPLIED PHYSICS LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

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

1. Acquire knowledge in experiments of modern physics
2. Understand the characteristics of various semiconductor devises
3. Work with lasers and optical fibers

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

1. Understand the various applications of semiconductor devices and their suitability in engineering
2. Demonstrate the working of lasers and optical fibers and their applications in the field of Communication
3. Analyze the electrical properties of a given solid based on its energy band gap
4. Verify the resistance and thermoelectric power properties with temperature variation
5. Demonstrate the Concept of electron and its charge experimentally

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	2	2	1	1	1	1	1	1	1	1	-	-
2	2	1	1	1	1	1	2	1	1	1	1	1	-	-
3	1	1	2	1	1	1	1	1	1	1	1	1	-	-
4	1	1	1	1	1	1	1	1	1	1	1	1	-	-
5	1	1	1	1	1	1	1	1	1	1	1	1	-	-

List of Experiments:

1. Planck"s Constant – Determination of Planck"s Constant using photo cell
2. Solar Cell – Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance
3. Hall Effect– Determination of Hall Coefficient, carrier Concentration & mobility of charge carriers of given semiCOnductor specimen
4. P-N Junction Diode – Study of V-I characteristics and calculation of resistance of given diode in forward and reverse bias
5. Laser – Determination of wavelength of given semiconductor red laser
6. Fibre Optics – Determination of NA and power losses of given optical fibre
7. Energy Gap – Determination of energy gap of given semiconductor
8. Thermistor – Determination of temperature Coefficient of resistance of given thermistor
9. *e/m* of Electron by Thomson"s Method
10. Thermoelectric Power – Determination of thermoelectric power of given sample

Note: A student must perform a minimum of eight experiments.

Suggested Reading:

1. "Applied Physics"- Manual by Department of Physics, CBIT, 2016
2. S.K. Gupta, "Engineering Physics Practical", Krishna"s Educational Publishers, 2014
3. O.P. Singh, V. Kumar and R.P. Singh, "Engineering Physics Practical Manual", Ram Prasad & Sons Publications, 2009

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16CY C03

ENGINEERING CHEMISTRY LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives:

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory
2. For practical understanding of theoretical COncept of chemistry

Course Outcomes:

1. Identify the basic Concepts in chemical analysis of various substances
2. Estimate the amount of chemical substances by volumetric analysis.
3. Calculate the Concentration and amount of various substances using instrumental techniques
4. Determine the distribution Coefficient of immiscible liquids
5. Develop the procedures to synthesize the basic polymeric Compounds.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	1	-	2	2	1	-	-	-	2	-	1
2	3	2	1	1	-	2	2	1	-	-	-	2	-	1
3	3	2	1	2	2	2	2	1	-	-	-	2	-	-
4	3	2	1	1	-	2	2	1	-	-	-	2	-	1
5	3	2	2	2	-	2	2	1	-	-	-	2	-	1

List of Experiments:

1. Introduction to chemical analysis.
2. Preparation of standard solution of oxalic acid and Standardization of NaOH
3. Estimation of amount of Fe^{+2} in the given solution using Mohr‟s salt and $KMnO_4$
4. Estimation of amount of Fe^{+2} in the given solution using Mohr‟s salt and $K_2Cr_2O_7$
5. Estimation of amount of Copper in the given solution using hypo solution.
6. Estimation of amount of HCl pH metrically using NaOH solution
7. Estimation of amount of CH_3COOH pH metrically using NaOH solution
8. Determination of Concentration of given KMnO4 solution Calorimetrically
9. Determination of Concentration of given $K_2Cr_2O_7$ solution Calorimetrically
10. Distribution of acetic acid between n-butanol and water.
11. Distribution of benzoic acid between benzene and water
12. Preparation of urea – formaldehyde / phenol- formaldehyde resin.

Suggested Reading:

1. Vogel‟‟ S text book of quantitative chemical analysis by J. Mendham and Thomas,Person education Pvt.Ltd New Delhi ,6th ed. 2002
2. Laboratory Manual on Engineering Chemistry by Dr. Subdharani (Dhanpat Rai Publishing
3. A Textbook on experiment and calculation in engineering chemistry by S.S. Dara S.Chand
4. Instrumental methods of Chemical Analysis, MERITT & WILLARD East-West Press

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Choice Based Credit System (CBCS)

Name of the Programme (UG):

B.E Syllabus for Semester III and IV - Semester

With effect from 2017 - 2018

Specialization /Branch: Computer Science and Engineering

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Hyderabad-500075, Telangana State.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
Choice Based Credit System
B.E (Computer Science and Engineering)

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	16MT C05	Engineering Mathematics –III	3	-	3	30	70	3
2	16CS C03	Data Structures	3	-	3	30	70	3
3	16CS C04	Object Oriented Programming using Java	3	-	3	30	70	3
4	16CS C05	Logic and Switching Theory	3/1	-	3	30	70	4
5	16CS C06	Discrete Structures	3/1	-	3	30	70	4
PRACTICALS								
6	16CS C07	Data Structures Lab	-	3	3	25	50	2
7	16CS C08	Object Oriented Programming Lab Using Java	-	3	3	25	50	2
8	16EG C03	Soft Skills and Employ- ability Enhancement Lab	-	2	2	15	35	1
9	16CS C09	Mini Project-I	-	2	2	50	-	1
TOTAL			**17**	**10**	**-**	**265**	**485**	**23**

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

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Assessment Procedures for Awarding Marks

The distribution of marks is based on CIE by concerned teacher and the Semester end examination shall be as follows:

Course (in terms of credits)	CIE	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	20*	50***	Theory	2 Hours
Two(2) Credits	25	50	Lab Course/Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
Two(2) Credits	50	—	Project Seminar/Seminar	----
Six(6) Credits	50	100	Project	Viva-Voce
One(1) Credit	—	50***	Environmental Studies, Professional Ethics and Human values	2 Hours
One(1) Credit	50		Mini Project	-----

CIE: Continuous Internal Evaluation

* Out of 30/20 sessional marks(CIE), 10/5 marks are allotted for slip-tests(Three slips test will be conducted, each of 10/5 marks, best two average is considered) and the remaining marks are based on the average of two tests, weightage for each test is 20/15 marks.

** The question paper will be in two parts, Part-A and Part-B. Part A is for Ten(10) questions and is compulsory, covers 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)

***The question paper will be in two parts, Part-A and Part-B. Part A is for Ten(10) questions and is compulsory, covers the entire syllabus, and carries 15 marks. Part-B carries 35 marks and covers all the units of the syllabus (student has to answer five out of seven questions)

Note:A course that has CIE(sessional marks) but no semester end examination 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 for theory course is 40% of total marks i.e., CIE plus semester end examinations where as for the lab course/project is 50%.

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16MT C05

ENGINEERING MATHEMATICS-III

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

Course objectives:

1. To study the expansion of functions in various intervals.
2. To form P.D.E and to find its solution.
3. To solve Wave, Heat & Laplace equations.
4. To learn Differentiation and Integration of complex valued functions.
5. To evaluate Complex Integration.
6. To evaluate Real definite integrals.

Course outcomes: On the successful completion of this course the student will be able to

1. Expand functions in the given intervals.
2. Solve linear and non linear PDEs.
3. Solve one-dimension, two-dimension, Heat steady state equations and also one-dimension wave equation.
4. Solve problems on Analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Expand functions by using Taylor's and Laurent's series.
6. Solve Real and Complex integrals by using Cauchy Theorems.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	-	-		-	-	-	-	1	-	-	-
2	3	2	1	-	-	-	-	-	-	-	1	-	-	-
3	2	2	1	-	1	-	-	-	-	-	1	-	-	-
4	2	2	1	-	1	-	-	-	-	-	1	-	-	-
5	3	2	1	-	1	-	-	-	-	-	1	-	-	-
6	3	2	1	--	1			-	-	-	1	-	-	-

UNIT - I

Fourier series: Definition of Periodic, Single valued, finite maxima and minima of functions. Euler's Formulae, Dirichlets Conditions for Fourier expansion, Functions having points of discontinuity, Change of interval, Expansion of odd and even functions, Half-range sine series and cosine series.

UNIT-II:

Partial differential equations: Formation of partial differential equations by eliminating the arbitrary constants or arbitrary functions, solutions of linear partial differential equation of first order by using Lagrange's Method, solution of Non-linear partial differential equations of first order by using standard types, Charpit's Method.

UNIT - III

Applications of Partial differential equations: Solution of partial differential equations by using method of separation of variables, solution of vibration of a stretched string (1D-Wave equation), one dimensional heat equation, Two dimensional heat equation under steady state conditions.

UNIT - IV

Theory of Complex variables: Analytic functions, Cauchy Riemann equations (Cartesian and polar forms), construction of Analytic functions by using Milne-Thomson's method. Harmonic function. Complex line integrals, Cauchy's theorem, Cauchy's Integral formula and its derivatives and problems related to the above theorems.

UNIT - V

Expansion of functions, Singularities & Residues: Taylor's and Laurent's series Expansions (Only statements). Zeros, types of singularities, Residues and Cauchy's Residue theorem, Evaluation of real integrals by Cauchy's residue theorem. Improper real integrals of the type: $\int_{-\infty}^{\infty} f(x)dx$ Where f(x) has no poles on real axis and $\int_0^{2\pi} f(\sin\theta,\cos\theta)d\theta$

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Text Books:

1. M.D. Raisinghania, "Advanced Differential equations", 7th edition, S Chand publishers, 2013.
2. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7^{th} edition, McGraw Hill publishers, 2003.
3. B.S. Grewal, "Higher Engineering Mathematics", 43^{rd}. Khanna Publishers, 2015

Suggested Reading:

1. N P Bali and Manish Goyal, "A Text Book of Engineering Mathematics", 9^{th} Edition, Laxmi publishers, 2016.
2. Alan Jeffrey, "Mathematics for Engineers and Scientists", 6^{th} Edition, Chapman & Hall/CRC publishers, 2013.
3. A R Vasistha and R K Gupta, "Integral transforms", Krishna prakashan publishers, 2004.
4. R.K.Jain & S.R.K.Iyenger, "Advanced Engineering Mathematics", 3^{rd} edition, Narosa Publications, 2007.

16CS C03

DATA STRUCTURES

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 teach the importance of structuring the data for easy access and storage.
2. To teach the implementation of various data structures.
3. To acquire skills in using generic principles for data representation and manipulation with a view for efficiency, maintainability and code reuse.
4. To introduce the basic concepts of advanced data structures.

Course Outcomes

1. Understand the importance of abstract data type and implementing the concepts of data structure using abstract data type.
2. Evaluate an algorithm by using algorithmic performance and measures.
3. Distinguish between linear and non-linear data structures and their representations in the memory using array and linked list.
4. Develop applications using Linear and Non-linear data structures.
5. Apply the suitable data structure for a real world problem and think critically for improvement in solutions.
6. Determine the suitability of the standard algorithms: Searching, Sorting and Traversals.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	1	1	1	1	-	-	1	1	2	1	1
2	3	2	3	2	3	2	1	1	2	2	2	2	1	1
3	3	2	3	-	3	-	-	1	1	2	2	2	1	1
4	3	3	2	3	3	2	-	1	1	2	1	2	1	2
5	3	3	3	3	2	2	-	1	2	2	2	2	1	2
6	3	3	3	3	3	3	-	1	2	2	2	2	1	2

NIT-I

Algorithm Specification, Performance Analysis and Measurement. **Arrays:** The Array as an Abstract Data Type, Polynomial Abstract Data Type, Sparse Matrices, Memory Layout of Array.

Sorting Algorithms: Stability and In Place Properties: Insertion sort, Quick sort, Selection Sort, Merge Sort, Linear Sorting Algorithms: Counting Sort, Bucket Sort.

UNIT-II

Stacks and Queues: The Stack Abstract Data Type, Array representation of Stacks, Applications of Stack: Infix to Postfix, Evaluation of Postfix expression, The Queue Abstract Data type, Array representation of Queue, Application of Queue: Radix Sort.

Dictionaries: The Dictionary Abstract Data type, Linear Search and Binary Search, Static Hashing.

UNIT-III

Linked Lists: The List Abstract Data type, Singly Linked linear Lists, Circular Lists, Linked Stack, Linked Queue, Linked Polynomial, Doubly Linked List.

UNIT-IV

Trees: The Tree Abstract Data type, Introduction to Binary Trees, Binary Tree Traversal, Operations on Binary Tree-Height, Copy, Threaded Binary Trees and their Representation.

The Priority Queue Abstract data type, Heap Trees, Heap Sort, Binary Search Tree, Operations on Binary Search Tree-Insert, Delete, Search, Join and Split. AVL Tree: Insert and delete operations on AVL Tree, Splay Trees, B-Trees.

UNIT-V

Graphs: The Graph Abstract Data Type, Representations of Graph, Traversals of Graph-Breadth First Search and Depth First Search, Minimum Cost Spanning Trees (Prim's and Kruskal's Algorithms), Single Source Shortest Path-Dijkstra's Algorithm, All Pairs Shortest Path-Floyd- Warshall's Algorithm, transitive closure.

Text Books:

1. "Fundamentals of data structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed 2nd edition.
2. "Data Structures using C", Aaron M tenenbaum, Yedidyah Langsam, Moshe J Augenstein, Pearson Education 7th edition.

Suggested Reading:

1. "Data Structures Using C", E Balagurusamy, Tata Mc-Graw-Hill Education, 2013.
2. "Data Structures and Program Design in C", Robert L Kruse, Bruce P, Leung, Clovis L Tondo, PHI.

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16CS C04

OBJECT ORIENTED PROGRAMMING USING JAVA

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. Write, compile and execute Java programs.
2. Understand the role of the Java Virtual Machine in achieving platform independence.
3. Use threads in order to create more efficient Java programs.
4. Write, compile and execute event driven programming using Swing classes.

Course Outcomes:

1. Identify classes, objects, members of a class and the relationships needed to solve a problem.
2. Use interfaces and creating user-defined packages.
3. Utilize exception handling and Multithreading concepts to develop Java programs.
4. Compose programs using the Java Collection API.
5. Design a GUI using GUI components with the integration of event handling.
6. Create files and read from computer files.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	-	-	-	-	-	-	-	-	-	1	1
2	2	2	1	-	1	-	-	-	-	-	-	-	1	1
3	2	2	1	-	3	-	-	-	-	-	-	-	1	1
4	2	3	1	1	3	-	-	-	-	-	-	-	1	1
5	2	3	1	1	3	-	-	-	-	-	-	-	1	1
6	2	2	-	1	3	-	-	-	-	-	-	-	1	1

UNIT-I

OOP concepts - Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, Procedural and object oriented programming paradigms.

Java Programming Fundamentals-History of Java, Introducing Data Types and Operators, Program Control Statements, Introducing Classes, Objects and Methods, String handling, Command line arguments .

Inheritance - Inheritance hierarchies, super and subclasses, Member access rules, super keyword, preventing inheritance: final classes and methods, the Object class and its methods.

Polymorphism - method overloading and overriding, abstract classes and methods.

Interfaces - Interfaces vs. Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interfaces.

UNIT-II

Inner classes - uses of inner classes, local inner classes, anonymous inner classes, static inner classes, examples.

Packages - Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

Exception handling - Dealing with errors, benefits of exception handling, exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re throwing exceptions, exception propagation, user defined exception.

UNIT-III

Multithreading - Difference between multiple processes and multiple threads, thread states, creating threads, interrupting threads, threads priorities, synchronizing threads, inter process thread communication.

Collection Framework in Java - Introduction to Java Collection Frame work, Collection hierarchy, List, Set, Map, Iterators, Legacy classes, String Tokeniser.

UNIT-IV

Applets - Inheritance hierarchy for applets, differences between applets and applications, life cycle of an applet, passing parameters to applets, applet security issues.

GUI Programming with Java - The AWT class hierarchy, Introduction to Swing, Swing vs AWT, Hierarchy for Swing components, Containers - JFrame, JApplet, JDialog, JPanel, Overview of some swing components Jbutton, JLabel, JTextField, JTextArea, simple swing applications, Layout managers.

Event handling - Events, Event sources, Event classes, Event Listeners, Relationship between Event sources and Listeners, Delegation event model, handling mouse and key events, Adapter classes.

UNIT-V

Files - streams - Byte stream and Character stream classes, text input/output, binary input/output, File management using File class, Serialization.

Text Books:

1. Herbert Schildt & Dale Skrien, "Java Fundamentals-A Comprehensive Introduction", 2013 Edition, Tata McGraw-Hill.
2. Herbert Schildt, "The Complete Reference Java", 7th Edition, Tata McGraw-Hill 2007.

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Suggested Reading:

1. "Java for Programmers", P.J. Deitel and H.M. Deitel, Pearson education (OR) Java: How to Program P.J. Deitel and H.M. Deitel, PHI.
2. "Object Oriented Programming through Java", P. Radha Krishna, Universities Press.
3. "Programming in Java", S. Malhotra and S. Choudhary, Oxford Univ. Press.

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16CS C05

LOGIC AND SWITCHING THEORY

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 architecture of basic building blocks, logic gates, Adders, Subtractors and Multipliers other digital devices.
2. To understand the logic of minimization techniques including Quine-Mcclusky method.
3. To analyze and design the Combinational and Sequential circuits.
4. To familiarize the notations of HDL descriptions in VHDL.

Course Outcomes

1. Can familiarize with number systems, simplification of Boolean functions.
2. Be able to manipulate simple Boolean expressions using maps and tabulation method.
3. Realize and Implement logic circuits by using Universal gates.
4. Ability to Design basic digital circuits in Computer Hardware and system.
5. Ability to use high level Hardware Description languages such as VHDL for the design of Combinational and Sequential circuits.
6. Be able to configure registers and counters for different applications.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	1	3	-	-	-	-	-	-	-	-
2	3	3	3	3	2	3	-	-	-	-	-	-	-	-
3	3	3	3	3	3	3	-	-	-	-	-	-	-	-
4	3	3	3	1	2	1	-	-	-	-	-	-	-	-
5	3	3	2	2	3	3	-	-	-	-	-	-	-	-
6	3	3	3	3	3	3	-	-	-	-	-	-	-	-

UNIT-I

Digital Computers and Information: Information representation, Computer Structure. **Number Systems:** Binary Numbers, Octal and Hexadecimal Numbers, Number Ranges.

Arithmetic Operations: Conversion from Decimal to other bases, Binary Addition and Subtraction, BCD Addition.

Alphanumeric Codes: ASCII Character Code, Parity Bit.

Binary Logic and Gates: Binary Logic, Logic Gates.

Boolean Algebra: Basic Identities, Algebraic Manipulation, Complement of afunction.

Standard Forms: Miniterms and Maxterms, sum of products and products of sums.

UNIT-Il

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 - Ill

Combinational Logic Design: Combinational Circuits,

Design Topics: Design Hierarchy, Top-Down design, Computer Aided Design, Hardware Description Languages, Logic Synthesis.

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 - VHDL.

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 - VHDL.

UNIT - V

Registers and Counters: Registers, Shift registers, Synchronous Binary counters, Ripple counter.

Symmetric functions and Networks: Properties and identification of symmetric functions, Symmetric Networks.

Text Books:

1. M. Moris Mano, Charles R. Kime, Logic and Computer Design Fundamentals, 2nd edition, Pearson Education Asia, 2001.
2. ZVI Kohavi, Switching and Finite Automata Theory, 2nd edition, Tata McGraw Hill, 1995.

Suggested Reading:

1. H.T. Nagle, Introduction to Computer logic, Prentice Hall, 1975.

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16CS C06

DISCRETE STRUCTURES

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 introduce Propositional and Predicate Logic to the students.
2. To introduce various proof techniques for validation of arguments.
3. To develop an understanding of counting, functions and relations.
4. To make the students familiar with fundamental notions and applicability of algebraic systems and graph theory.

Course Outcomes

1. Apply Propositional and Predicate logic for a variety of problems in various domains.
2. Understand Set Theory, Venn Diagrams, relations, functions and apply them to Real-world scenarios.
3. Model and solve the real world problems using Generating Functions and Recurrence Relations.
4. To identify the basic properties of graphs and trees and use these concepts to model simple applications.
5. Understand General properties of Algebraic systems and study lattices as partially ordered sets and their applications.
6. Apply the knowledge and skills obtained to investigate and solve a variety of discrete mathematics problems.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	-	-	-	-	-		-	-		-	-
2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
5	2	1	-	-	-	-	-	-	-	-	-	-	-	-
6	2	-	-	-	-	-	-	-	-	-	-	-	-	-

UNIT-I

Fundamental Principles of counting: The Rules of Sum and Product, permutations, Combinations, Binomial Theorem.
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.
Applications

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:** one-one and Onto, Pigeonhole principle, partial ordering relations, POSET, hasse diagrams, Equivalence relations.
Applications

UNIT-III Generating function: Generating Functions, Function of Sequences, Calculating Coefficient of generating function.
Recurrence Relations: The First Order Linear Recurrence Relation, Second Order Linear. Homogenous Recurrence relations with constant coefficients, Non Homogenous Recurence Relations.
Applications

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

UNIT-V Algebraic Structures: Algebraic Systems: Examples and General Properties, Semigroups and Monoids, Groups: Definitions and Examples, Subgroups and Homomorphisms.
Lattices: Lattices as Partially Ordered Sets, Lattices as Algebraic Systems.
Applications

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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, KennyA.Hunt, "Computational Thinking for the modern problem solving", CRC Press, 2014.

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16CS C07

DATA STRUCTURES 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. Design and construct simple programs by using the concepts of structures as abstract data type.
2. To have a broad idea about how to use pointers 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:

1. Implement the abstract data type and reusability of a particular data structure.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implements non-linear data structures such as trees, graphs.
4. Implement various kinds of searching, sorting and traversal techniques and know when to choose which technique.
5. Understanding and implementing hashing techniques.
6. Decide a suitable data structure and algorithm to solve a real world problem.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	2		3	-	2	1	1	3	-	1	1	1	2
2	-	2		3	-	2	1	1	3	1	1	1	1	2
3	-	3		3	-	2	1	1	3	1	3	3	1	2
4	-	2		3	-	3	1	1	3	1	3	3	1	2
5	-	2		3	-	3	1	1	3	1	3	3	1	2
6	-	2	1	3	1	3	1	1	3	1	3	3	1	2

List of Experiments:

1. Implementation of Merge Sort and Quick Sort.
2. Implementation of Static Hashing (Use Linear probing for collision resolution).
3. Program to Convert given Infix Expression to Postfix and Evaluation of Postfix.
4. Implementation of Radix Sort.
5. Implementation of Insert, Delete and Search operations on Single Linked List & Circular Single Linked List.
6. Implementation of Stack and Queue using linked lists.
7. Implementation of Binary Tree and following operations on Binary Trees- Preorder, Postorder, Inorder and Level order traversals,
8. making a Copy of a Binary Tree, Find the Height of a Binary Tree.
9. Implementation of Heap Sort.
10. Implementation of Insert, Delete and Search operations on Binary Search Trees.
11. Implementation of Breadth First Search and Depth First Search on graph.
12. Implementation of Dijkstra's Algorithm and Floyd-Warshall's Algorithm.

Text Books

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

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16CS C08

OBJECT ORIENTED PROGRAMMING LAB USING JAVA

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. Cover the basics of creating Java programming, Multi-threading, Exception handling etc.
2. To expose GUI programming.

Course Outcomes:

1. Design interfaces and packages.
2. Compose program for implementation of multithreading concepts.
3. Develop program using Collection Framework.
4. Develop small GUIs using GUI components with the integration of event handling.
5. Handle I/O Streams from various sources.
6. Write programs using the Java Concepts.

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	2	2	1	-	1	-	-	-	-	-	-	-	1	1
2	2	2	1	-	1	-	-	-	-	-	-	-	1	1
3	2	3	1	1	3	-	-	-	-	-	-	-	1	1
4	2	3	1	1	3	-	-	-	-	-	-	-	1	1
5	2	2	-	1	3	-	-	-	-	-	-	-	1	1
6	2	2	1	-	-	-	-	-	-	-	-	-	1	1

List of Experiments:

1. A program to illustrate the concept of class with constructors, methods and access levels.
2. A program to illustrate the concept of inheritance and polymorphism.
3. A program to illustrate the usage of abstract, final and static classes and methods.
4. A program to illustrate the concept of multi-threading and thread synchronization.
5. A program to illustrate the concept of strings and stringtokenizer.
6. A program using ArrayList and LinkedLIst and iterator classes.
7. A program using TreeSet, HashSet and LinkedHashSet.
8. A program using Map Classes.
9. A program using Enumeration and Comparator Interfaces.
10. An application involving GUI with different controls, menus, Scrollbar and Event handling.
11. A program to implement Applet.
12. A program to illustrate the usage of all I/O Streams.
13. A program to illustrate the usage of Serialization.
14. Case Study using GUI and Threads.

Suggested Reading:

1. Herbert Schildt, java Fundamentals, Indian Edition, McGraw hill 2013.
2. Wigglesworth and Mcmillan, Java Programming: Advanced Topics, 3rd Edition, Cenage learning 2013.

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16EG CO3

SOFT SKILLS AND EMPLOYABILITY ENHANCEMENT 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: To help the students

1. Participate in group discussions and case studies with confidence and to make effective presentations. Also to learn the art of communication.
2. With- resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management & goal setting, self confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.
5. To understand the elements of research and hone their soft skills through a live, mini project.

Course Outcomes: The 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 mange 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.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	1	-	2	3	3	2	3	1	-
2	-	-	-	-	-	-	-	-	2	1	1	1	-	-
3	-	-	-	-	-	-	-	3	2	1	3	3	-	-
4	-	-	-	-	-	1	-	3	3	2	2	2	1	-
5	1	1	1	1	1	1	-	3	3	3	2	2	1	-

Exercise 1

Group Discussion and Case studies: Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Elements of effective presentation, Structure of presentation, Presentation tools, Body language, Creating an effective PPT.

Exercise 2

Interview Skills: Resume writing, structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets.

Interview Skills: concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews.

Exercise 3

Personality Development: Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.

Exercise 4

Corporate Culture: Grooming and etiquette, communication media etiquette.

Academic ethics and integrity.

Exercise 5

Mini Project: General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar.

Suggested Reading:

1. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006.
2. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010.
3. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989.

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16CSC09

MINI PROJECT-I

Instruction	2 Hours per week
Duration of Semester End Examination	-
Semester End Examination	-
CIE	50 Marks
Credits	1

The students are required to carry out mini projects in any of the areas such as Programming and Problem Solving, Object Oriented Programming through JAVA.etc.

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

1. Practice acquired knowledge within the chosen area of technology for project development
2. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach
3. Reproduce, improve and refine technical aspects for engineering projects
4. Work as an individual or in a team in the development of technical projects
5. Interpret, analyze and evaluate the experimental results
6. Effectively communicate and report the project effectively activities and findings

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	--	--	--	--	--	--	--	--	--	2	2	2	2
2	2	2	3	--	--	--	--	2	--	--	--	2	--	--
3	2	--	--	3	2	--	--	1	--	--	--	--	--	--
4	--	--	--	--	--	--	--	1	3	--	--	--	--	--
5	2	--	--	3	2	2	2	--	--	--	--	--	--	--
6	2	--	--	--	2	--	--	2	--	3	--	--	--	2

Students are required to submit a report on the mini project at the end of thesemester

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
Choice Based Credit System
B.E (Computer Science and Engineering)

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	16CS C10	Data Base Management Systems	3	-	3	30	70	3
2	16CS C11	Web Technologies	3	-	3	30	70	3
3	16CS C12	Computer Architecture and Micro Processors	3/1	-	3	30	70	4
4	16CS C13	Probability and Statistics Using R	3	-	3	30	70	3
5	16CS E01/02/03	ELECTIVE - I	3	-	3	30	70	3
6	16MB C01	Engineering Economics and Accountancy	3	-	3	30	70	3
PRACTICALS								
7	16CS C14	Data Base Management Systems Lab	-	3	3	25	50	2
8	16CS C15	Web Technologies Lab	-	3	3	25	50	2
9	16CS C16	CA and MP Lab	-	3	3	25	50	2
TOTAL			**19**	**9**	**-**	**255**	**570**	**25**

ELECTIVE-I

S.No.	Course Code	Title of the Course
1	16CS E01	Linux Programming and Scripting Languages
2	16CS E02	Principle of Programming Languages
3	16CS E03	Shell Scripting

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

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Assessment Procedure for Awarding Marks

The distribution of marks is based on CIE by concerned teacher and the Semester end examination shall be as follows:

Course (in terms of credits)	CIE	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	20*	50***	Theory	2 Hours
Two(2) Credits	25	50	Lab Course/Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
Two(2) Credits	50	—	Project Seminar/Seminar	----
Six(6) Credits	50	100	Project	Viva-Voce
One(1) Credit	—	50***	Environmental Studies, Professional Ethics and Human values	2 Hours
One(1) Credit	50		Mini Project	-----

CIE: Continuous Internal Evaluation

* Out of 30/20 sessional marks(CIE), 10/5 marks are allotted for slip-tests(Three slips test will be conducted, each of 10/5 marks, best two average is considered) and the remaining marks are based on the average of two tests, weightage for each test is 20/15 marks.

** The question paper will be in two parts, Part-A and Part-B. Part A is for Ten(10) questions and is compulsory, covers 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)

***The question paper will be in two parts, Part-A and Part-B. Part A is for Ten(10) questions and is compulsory, covers the entire syllabus, and carries 15 marks. Part-B carries 35 marks and covers all the units of the syllabus (student has to answer five out of seven questions)

Note:A course that has CIE(sessional marks) but no semester end examination 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 for theory course is 40% of total marks i.e., CIE plus semester end examinations where as for the lab course/project is 50%.

Professor and Head Department

16CS C10

DATA BASE MANAGEMENT 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 get familiar with fundamental concepts of database management which includes database design, database languages, and database-system implementation.
2. To get familiar with data storage techniques and indexing.
3. To impart knowledge in transaction Management, concurrency control techniques and recovery techniques.

Course Outcomes:

On the successful completion of this course the 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.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	-	1	-	-	-	-	-	-	-	1	2
2	1	3	3	-	3	-	-	-	-	-	-	-	1	2
3	2	2	3	2	2	-	-	-	-	-	-	-	1	2
4	1	2	2	2	2	-	-	-	-	-	-	-	1	2
5	1	2	2	1	2	-	-	-	-	-	-	-	1	2
6	1	3	3	2	2	-	-	-	-	-	-	-	1	2

UNIT-I

Introduction : Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Specialty Databases, Data Storage and Querying, 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, Other Aspects of Database Design.

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: Overview - SQL Data Types, Basic Structure of SQL Queries, Modification of the Database (DML), Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Nested Sub queries, Views, Join Expression. Triggers, Index Definition, Procedures and Functions, JDBC, ODBC, Embedded SQL.

UNIT-III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Basic Definitions, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Non-loss Decomposition and Functional Dependencies, Normalization - 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF, Multi-valued Dependencies and 4NF, Join Dependencies and 5NF.

Indexing: Overview of Indexes, Properties of Indexes, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files, Bitmap Indices.

UNIT-IV

Hashing: Static Hashing, Dynamic Hashing - Extendible Hashing, Linear 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 Granularities.

UNIT-V

Deadlocks: Deadlock Prevention, Deadlock Detection, Performance of Lock-Based Concurrency Control, Specialized Locking

Techniques - Dynamic Databases and the Phantom Problem.

Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, 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", 8th Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, JohnnesGehrke, "Database Management Systems", Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul V L N Somayazulu, Shamkant B Navathe, Shyam K Gupta, "Fundamentals of Database Systems", Fourth Edition, Pearson Education, 2006.

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16CS C11

WEB TECHNOLOGIES

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 acquire knowledge of XHTML, CSS and XML to develop web applications
2. Ability to develop web application using PHP.
3. Ability to develop dynamic web content using Java Servlets and JSP.
4. To understand JDBC connections.
5. To understand the design and development process of a complete web application.
6. To understand the concepts of Ruby and Rails.

Course Outcomes: Students will be able to

1. Develop sites using XHTML using CSS and XML.
2. Develop form processing using java scripts.
3. Develop Dynamic web site using PHP applications.
4. Develop Dynamic web content using Java Servlets and JSP.
5. Develop JDBC connections and implement a complete Dynamic web application.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	2	1	3	2	1	2	3	3	1	2	2	3
2	2	1	2	1	3	2	1	2	3	3	1	2	2	3
3	3	3	3	2	3	3	3	2	3	3	2	3	2	3
4	3	3	3	2	3	3	3	2	3	3	2	3	2	3
5	2	1	2	1	3	2	1	2	3	3	1	2	2	3

UNIT - I

Fundamentals Introduction to the Internet, WWW Browsers, Web Servers, URL, MIME, HTTPS.

Introduction XHTML : Evolution XHTML,Basic Syntax Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists Tables, Forms, Cascading Style Sheets.

Introduction to XML : Introduction,Uses of XML,The Syntax of XML,XML Document Structure,Namespaces,XML Schemas,Displaying Raw XML Documents, Displaying XML Documents with CSS, XSLT Style Sheets.

UNIT-II

JavaScript : Overview of JavaScript, Object Orientation and JavaScript, General Syntactic Characteristics, Primitives, Operations, and Expressions, Screen Output and Keyboard Input, Control Statements,

Object Creation and Modification. Arrays, Functions, An Example, Constructors, Pattern Matching Using Regular Expressions, Errors in Scripts.

JavaScript : The JavaScript Execution Environment, The Document Object Model, Element Access in Java Script, Events and Event Handling, Handling Events from Body Elements, Handling Events from Button Elements, Handling Events from Text Box and Password Elements, The DOM 2 Event Model, The canvas Element . The navigator Object, DOM Tree Traversal and Modification

Dynamic Documents with JavaScript : Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Colors and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements

UNIT - III

Introduction to PHP : Overview of PHP, General Syntactic Characteristics, Primitives, Operations, and Expressions, Output, Control Statements. Arrays, Functions, Pattern Matching, Form Handling, Cookies, Session Tracking.

UNIT - IV

J2EE Platform: Enterprise Architecture Styles, Containers and Technologies

Servlet: introduction of Servlet, Servlet Life cycle, Request and Responses.

JSP: Introduction to JSP, Directives, Scripting Elements, Standard Objects, **JSP Tag extensions:** Tag extensions, A simple Tag Anatomy of a Tag extension, Writing Tag Extensions, Form Handling, Cookies, Session Tracking .

UNIT - V

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Database Access through the Web : Relational Databases, An Introduction to the Structured Query Language, Architectures for Database Access, The MySQL Database System, Database Access with PHP and MySQL, Database Access with JDBC and MySQL .Connecting to a MySQL Database using servlet and jsp.

Text Books:

1. Internet & World Wide Web How to program - M. Deitel, P.J. Deitel, A. B. Goldberg, 3rd Pearson Education.
2. Programming the World Wide Web -Robert W. Sebesta, 4th Pearson Education .

Suggested Reading:

1. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech.
2. Jdbc 4.2 Servlet 3.1 & Jsp 2.3 Includes Jsf 2.2 & Design Patterns Black Book Santosh Kumar K Dreamtech.

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16CS C12

COMPUTER ARCHITECTURE AND MICRO PROCESSORS

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 operation, interaction, communication among the functional units of a Computer System.
2. To understand the concrete representation of data at the machine level and how computations are performed at the machine level.
3. To understand the advantage of instruction level parallelism and pipelining for high performance processor design.
4. To learn the architecture and addressing modes of 8086 processor.
5. To understand instruction set of 8086, interrupts and to learn programming in 8086.
6. To understand the functionality and interfacing of various peripheral devices with 8086 processor.

Course Outcomes

1. Ability to understand the merits and pitfalls in computer performance measurements.
2. Achieve Technical knowledge on the advantage of instruction level parallelism and pipelining for high performance processor design.
3. Identify the basic elements and functions of 8086 microprocessors.
4. Understand the instruction set of 8086 and use them to write assembly language programs.
5. Demonstrate fundamental understanding on the operation between the microprocessor and its interfacing devices.
6. Ability to write complex programs involving interface with various peripheral devices.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	3	1	2	-	-	-	-	2	-	-	-	-
3	3	-	1	-	-	-	-	-	-	-	-	-	-	-
4	-	3	3	3	-	-	-	-	-	2	-	-	-	2
5	2	-	-	-	-	-	2	-	-	3	-	-	1	2
6	-	-	2	3	-	-	-	-	-	3	-	-	1	2

Prerequisites: Digital Electronics and Logic Design

UNIT-I

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi-computers.

Basic Processing Unit: Fundamental concepts, Execution of a complete instruction, Multiple- Bus organization, Hardwired control, Microprogrammed control.

Arithmetic: Addition and Subtraction of Signed numbers, Design of fast adders, Multiplication of positive numbers, Signed-Operand Multiplication, Integer Division.

UNIT-II

The Memory System: Cache Memories, Performance considerations, Virtual Memories, Memory Management requirements, Secondary Storage.

Pipelining: Basic concepts, Data hazards, Instruction hazards, Influence on instruction sets, Datapath and control considerations, Superscalar operation, Performance considerations.

UNIT-III

8086 Architecture: CPU Architecture, Internal operation, Machine language instructions Addressing modes, Instruction formats, Instruction execution timing.

Assembler Language Programming: Instruction format, Data transfer instructions.

Arithmetic instructions: binary arithmetic, packed BCD arithmetic, unpacked BCD arithmetic.

UNIT-IV

Assembler 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.

Byte and String Manipulation: String instructions, REP prefix.

UNIT-V

I/O Programming: Fundamental I/O considerations, Programmed I/O, Interrupt I/O, Block transfers and DMA.

I/O Interfaces: Serial Communication Interface: 8251A Programmable Communication Interface, Parallel Communication;

8255A Programmable Peripheral Interface, A/D and D/A example.

Programmable Timers and Event Counters: 8254 Programmable Interval Timer, Interval timer application to A/D, DMA Controllers.

Text Books:

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

Suggested Reading:

1. M. M. Mano, "Computer System Architecture", 3^{rd} Prentice Hall,
2. William Stallings, "Computer Organisation and Architecture, Design for Performance", Pearson, 9^{th} Edition, 2013.
3. Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata Mc Graw Hill, Revised 2^{nd} Edition,2007.
4. Brey B.Brey, "The Intel Microprocessor, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium
5. Pro-Processors-Architecture, Programming and interfacing", 4^{th} Edition, Prentice Hall, 1993.

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16CS C13

PROBABILITY AND STATISTICS USING R

Instruction3 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 the basic R operations and concepts and to have a deep understanding about data description.
2. To study the discrete/continuous random variables and multivariate distributions.
3. To introduce the concept on sampling distributions which leads to inferential statistics.
4. To give a brief idea about point and interval estimation, hypothesis testing, and introductions to selected topics in applied statistics.

Course Outcomes: Student will be able to

1. Know the fundamentals of probability and statistics.
2. Understand and interpret different types of data.
3. Apply statistical tools on data sets.
4. Understand and use the R tool for statistical analysis.
5. Evaluate various testing on data.
6. Apply the concepts of statistics to real-life datasets and analyze using R.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	1				2	1	1			3
2	2	1	2	2	2	1		2	2	2	1	1	1	2
3	2	1	3	2	2	1			2	2	1	1	1	2
4	2	1	3	3	2	2	1	1	2	1	1	1	1	2
5	2	2	2						2		2			2
6	2	2	3	3	2	2	2	2	2	2	2			2

UNIT-I

Introduction to R: Software preparation, Basic R operations and concepts **Data Description:** Types of Data, Features of Data Distributions, Descriptive Statistics, Exploratory Data Analysis, Multivariate Data and Data Frames, Comparing Populations.

UNIT-II

Probability: Sample Spaces, Events, Model Assignment, Properties of Probability, Counting Methods, Conditional Probability, Independent Events, Bayes' Rule, Random Variables.

Discrete Distributions: Discrete Random Variables, The Discrete Uniform Distribution, The Binomial Distribution, Expectation and Moment Generating Functions, The Empirical Distribution, Other Discrete Distributions, Functions of Discrete Random Variables.

UNIT-III

Continuous Distributions: Continuous Random Variables, The Continuous Uniform Distribution, The Normal Distribution, Functions of Continuous Random Variables, Other Continuous Distributions.

Multivariate Distributions: Joint and Marginal Probability Distributions, Joint and Marginal Expectation, Conditional Distributions, Independent Random Variables, Exchangeable Random Variables, The Bivariate Normal Distribution, Bivariate Transformations of Random Variables, Remarks for the Multivariate Case, The Multinomial Distribution.

UNIT-IV

Sampling Distributions: Simple Random Samples, Sampling from a Normal Distribution, The Central Limit Theorem, Sampling Distributions of Two-Sample Statistics, Simulated Sampling Distributions.

Estimation: Point Estimation, Confidence Intervals for Means, Confidence Intervals for Differences of Means, Confidence Intervals for Proportions, Confidence Intervals for Variances, Fitting Distributions, Sample Size and Margin of Error.

Hypothesis Testing: Introduction, Tests for Proportions, One Sample Tests for Means and Variances, Two-Sample Tests for Means and Variances, Other Hypothesis Tests, Analysis of Variance, Sample Size and Power.

UNIT-V

Simple Linear Regression: Basic Philosophy, Estimation, Model Utility and Inference, Residual Analysis, Other Diagnostic Tools.

Multiple Linear Regression: The Multiple Linear Regression Model, Estimation and Prediction, Model Utility and Inference, Polynomial Regression, Interaction, Qualitative Explanatory Variables, Partial F Statistic, Residual Analysis and Diagnostic Tools.

Categorical Data Analysis, Nonparametric Statistics, Time Series

Text Books:

1. Introduction to Probability and Statistics Using R by G. Jay Kerns, 1st Edition, IPSUR, Publications - 2010.
2. Introduction to Probability with R (Chapman & Hall/CRC Texts in Statistical Science) Hardcover – 12 Feb 2008.

Suggested Reading:

1. Daniel Adler and Duncan Murdoch. rgl: 3D visualization device system (OpenGL), 2009. R package version 0.87. Available from: http://CRAN.R-project.org/package=rgl.
2. Agresti and B. A. Coull. Approximate is better than "exact" for interval estimation of binomial proportions. The American Statistician,52:119-126, 1998.
3. Alan Agresti. Categorical Data Analysis. Wiley, 2002. 223

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16MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

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

Course Objectives: The Objectives of the course are:

1. To introduce managerial economics and demonstrate its importance in managerial decision making.
2. To develop an understanding of demand and relevance of its forecasting in the business.
3. To provide the basics of market structure and the concept of equilibrium in different market structures.
4. To examine the economic analysis of production process, types of inputs and to explain different costs and their relationship with the output.
5. To understand the importance of project evaluation in achieving a firm's objective.
6. To explain the concept of Accountancy and provided knowledge on preparation and analysis of Final accounts.

Course Outcomes: After completion of the 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. Understand price determination for different markets.
4. Study production theory and analyze various costs & benefits involved in it so as to make best use of resources available.
5. Analyze different opportunities and come out with best feasible capital investment decisions
6. Apply accountancy concepts and conventions, Final accounts and financial analysis.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	3	1	1	1	1	1	1	1	2	-	-	2
2	2	2	2	2	2	1	1	1	-	1	1	1	-	1
3	1	2	1	2	2	-	2	1	-	1	1	-	-	1
4	2	2	1	2	2	1	1	3	-	1	1	-	-	1
5	1	3	1	2	1	1	2	-	-	1	2	1	1	2
6	1	2	-	-	1	1	1	1	-	1	2	-	-	1

UNIT-I:

Introduction to Managerial Economics

Introduction to Economics and its evolution - Managerial Economics - its scope, importance, Its usefulness to engineers - Basic concepts of Managerial economics.

UNIT-II:

Demand Analysis

Demand Analysis - Concept of demand, determinants, Law of demand, its assumptions, Elasticity of demand, price, income and cross elasticity, Demand Forecasting - Types of Market structures. (Simple numerical problems).

UNIT-III:

Production and Cost Analysis

Theory of Production, Firm and Industry, Production function, input-out relations - laws of returns, internal and external economies of scale. Cost Analysis: Cost concepts, fixed and variable costs, explicit and implicit costs, out of pocket costs and imputed costs, Opportunity cost, Cost output relationship, Break-even analysis. (Theory and problems).

UNIT-IV:

Accountancy

Book-keeping, principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments.

UNIT-V:

Capital Budgeting

Introduction to capital budgeting, Methods: traditional and discounted cash flow methods. Introduction to Working capital management. (Numerical problems).

Text Books:

1. Mehta P.L., "Managerial Economics - Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2013.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 2013.
3. Panday I.M. "Financial Management", Vikas Publishing House, 11th edition,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.

16CS E01

LINUX PROGRAMMING AND SCRIPTING LANGUAGES

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 Linux operating system and its environment.
2. To study about the principles of scripting languages.
3. To study scripting languages such as PERL, PyQt, Python and Bash.
4. To build applications in Linux environment using scripting languages.

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

1. Understand the structure and environment of Linux operating system.
2. Understand the features of scripting languages.
3. Develop applications in Linux environment.
4. Create and run scripts using Perl/TCL/Python.
5. Write shell scripts for the automation of system administration.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	1	-	-	-	-	-	-	1	-	-	1	1	1
2	-	1	-	-	-	-	-	-	1	-	-	1	1	1
3	-	1	2	1	2	-	-	1	3	3	3	2	1	2
4	-	1	2	1	2	-	-	1	3	3	3	2	-	2
5	-	-	2	1	2	-	-	1	3	3	3	2	-	2

UNIT-I

Linux Basics: Setting up Environment, parts of Linux operating system, advantages of Linux, commands, Linux users and groups, Permissions for file, directory and users, searching a file & directory, zipping and unzipping concepts.

UNIT-II

Linux Networking: Introduction to networking in Linux, Network basics and tools, File Transfer protocol in Linux, Network File System, Domain Name Services, Dynamic Host Configuration Protocol and Network Information Services.

UNIT-III

Perl Scripting: Introduction to Perl, advantages and working environment of PERL, variables, Strings, Statements, Subroutines, Files, Packages and Modules, Object-Oriented PERL.

UNIT-IV

PyQt: Introduction, Major Classes, Using Qt Designer, Signals and Slots, Layout management, Basic Widgets, QDialog Class, QMessage Box, Multiple document Interfaces, Drag and Drop, Database handling, Drawing API, Brushstyle Constants, QClipboard, QPixmap class.

UNIT-V

Introduction to Python, Using the Python Interpreter, More Control Flow Tools, Data Structures, Modules, Input and Output, Errors and Exceptions, Classes, Brief Tour of the Standard Library.

Suggested Reading:

1. M N Rao "Fundamentals of Open Source Software", PHI Learning Private Limited, 2015.
2. Instructor reference material.
3. Python Tutorial Release 3.2.3 by Guido van Rossum, and Fred L. Drake, Jr., editor, 2012.
4. Practical Programming in Tcl and Tk by Brent Welch , Updated for Tcl 7.4 and Tk 4.0.
5. Teach Yourself Perl 5 in 21 days by David Till.
6. Red Hat Enterprise Linux 4: System Administration Guide Copyright 2005 Red Hat, Inc.

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16CS E02

PRINCIPLES OF PROGRAMMING LANGUAGES

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 provide an introduction to formalisms for specifying syntax and semantics of programming languages.
2. To provide an exposure to core concepts and principles in contemporary programming languages.
3. To analyze and optimize the complexity of the programming languages.
4. To explore the concept of concurrent and parallel programming.

Course Outcomes: On the successful completion of this course the student will be able to
1. Program in different language paradigms and evaluate their relative benefits.
2. Gains knowledge of, and ability to use, language features in current programming languages.
3. Develop algorithms for problem solving.
4. Identify and describe semantic issues associated with variable binding, scoping rules, parameter passing, and exception handling.
5. Understand the design issues of object-oriented and functional languages.
6. Familiarity with using logic languages.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	-	-	-	-	-	-	-	-	-	-	-
2	1	1	-	-	-	-	2	-	-	-	-	-	-	-
3	-	-	1	-	-	-	3	-	-	-	-	-	-	-
4	-	1	-	-	-	-	3	-	-	-	-	-	-	-
5	-	-	1	-	-	-	-	-	-	-	-	-	-	-
6	2	-	-	-	-	-	-	-	-	-	-	-	-	-

UNIT-I

The Role of programming Languages: Towards Higher-level Languages, Programming Paradigms , Criteria for good language design and Language implementation.

Language Description : Expression notation, Abstract syntax tree, Context free Grammars.

UNIT-II

Structured Programming : Need for Structured programming, Design considerations, Handling special cases in loops, Programming with invariants, Control flow in C.

Types - Role of Types, Basic Types, Arrays, Records, Unions, Sets,

Pointers, Types and Error Checking.

Procedure Invocation: Introduction to Procedures, parameter passing methods, Scope Rules for Names, Nested Scopes, Activation Records.

UNIT-III

Object-Oriented Programming -Object, Object -oriented thinking , **Classes and Objects:** Defining classes and Member functions, Arrays, Static Members, Friend Functions. Constructors and Destructors: Type of Constructors, Dynamic Initialization of Objects, Destructors.

C++ operator overloading: Fundamentals, restrictions, overloading unary / binary operators, overloading ++ and --, Manipulation of Strings. C++ **Inheritance:** Defining derived classes, Types of Inheritance, Virtual Base class, Abstract Class, Nesting of classes.

UNIT-IV

C++ Templates: Introduction, class templates, member function template, overloading template functions., Objects in Smalltalk.

Functional Programming: Introduction to LISP, Exploring a List, Functions as First-class values, ML: types, function, List manipulation, Exception Handling in ML, Storage allocation for lists.

UNIT-V

Logic Programming: Computing with relations, Introduction to Prolog, Data structures in Prolog, Programming techniques, Control in Prolog, Cuts.

Concurrent Programming: Parallelism in Hardware, Liveness properties, Synchronization, Concurrency in Ada.

Suggested Reading:

1. Ravi Sethi, "Programming Languages", II Ed., Pearson Education asia, 2001.
2. Robert Lafore "Object-Oriented Programming in C++ " 4th Edition Sams Publishing,2002.
3. Robert W. Sebesta, "Concepts of Programming languages", 7th Edition., PearsonEducation.

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16CS E03

SHELL SCRIPTING

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. Understanding of the shell structure and its environment of Unix/Linux.
2. Learning the key features and fundamentals of bash environment.
3. Carrying out arithmetic operations in a shell script.
4. Creating interactive scripts incorporating various control constructs.
5. Understanding and implementing various functions.
6. Pattern matching and text processing using the tools.

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

1. Understand the basics of Linux shell scripting.
2. Familiarize with basic commands and text filtering tools.
3. Write shell scripts for automation to save and create utilities.
4. Start up a system and customize a Linux system using scripts.
5. Control administrative tasks such as Linux user management, system monitoring etc.
6. Identify patterns using Linux/Unix tools.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	-	-	1	-	-	-	-	-	-	1	-	-
2	1	-	-	-	1	-	-	-	-	-	-	1	1	1
3	1	1	1	1	1	-	-	1	1	1	-	2	1	1
4	1			1	2	-	-	1	1	1	-	1		
5	2	1	1	1	1	-	-	-	-	-	-	2	1	1
6	1	2	1	1	2	-	-	1	1	1	-	2	1	1

UNIT-I

Introduction to Linux shell and Scripting: Structure of Linux OS, Shell Scripting: Comparison of shells, tasks done by shell, working in shell, Learning basic Linux commands, compilers Vs. interpreters, when not to use scripts, Linux File system.

Process basics: ps, process management, process management tools-top, iostat and vmstat; at, crontab.

Text Processing and Filters: Text filtering tools, I/O redirection, Pattern matching with the vim editor, grep.

UNIT-II

Working with Commands: Learning shell interpretation of commands, command separators, logical operators.

Exploring Expressions and Variables: Environment variables, Read- only variables, command line arguments (special variables, set and shift, getopt), default parameters, working with arrays.

UNIT-III

Shell scripting: Interactive Shell scripts-reading user input, <<, >> operator, File handling, debugging.

Arithmetic operations in shell scripts: Using a command declare for arithmetic, let command for arithmetic expr; binary, octal and hex arithmetic operations, floating-point arithmetic.

UNIT-IV

Decision making in scripts: exit status of commands, test command, conditional constructs, single menus with select; Looping constructs; piping the output of a loop to a Linux command, running loops in the background, IFS and loops.

Functions: Introduction to functions, passing arguments, sharing of data, declaration of local variables, returning information from functions, running functions in the background, creating a library of functions.

UNIT-V

System startup and Customizing Linux System: System startup, inittab, and run levels, user initialization scripts.

Pattern matching: Basics of regular expressions, sed and awk.

Text Books:

1. Ganesh Sanjiv Naik, Learning Linux Shell Scripting, Packt Publishing, 2015. Open Source Community.
2. Sumithaba Das "Unix Concepts and Applications", 4th Edition, TMH, 2006.
3. Randal K Michael, "Mastering UNIX Shell Scripting", Wiley Publications, 2003.
4. N.B. Venkateswarlu, "Advanced Shell Programming", 1st Edition, BPB Publisher, 2010.

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16CS C14

DATA BASE MANAGEMENT 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 get familiar with the concepts of structured query language.
2. To understand about programming language/ structured query language (PL/SQL).
3. To get familiar with generation of form and open database connectivity.

Course Outcomes: On the successful completion of this course the student will be able to

1. Outline the built-in functions of SQL and apply these functions to write simple and complex queries using SQL operators .
2. Demonstrate Queries to Retrieve and Change Data using Select, Insert, Delete and Update. Construct Queries using Group By, Order By and Having Clauses
3. Demonstrate Commit, Rollback , Save point commands , SQL Plus Reports and Write Queries for Creating, Dropping and Altering Tables, Views, constraints .
4. Develop queries using Joins, Sub-Queries and Working with Index, Sequence, Synonym, Controlling Access and Locking Rows for Update, Creating Password and Security features.
5. Demonstrate the usage of data types , Bind and Substitution Variables , Anchored, Declarations ,Assignment Operation and PL/SQL code using Control Structures .
6. Develop PL/SQL code using Cursors, Exception, Composite Data Types and Procedures, Functions and Packages.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	-	2	-	-	-	-	-	-	-	1	2
2	2	3	3	-	2	-	-	-	-	-	-	-	1	2
3	2	3	3	-	2	-	-	-	-	-	-	-	1	2
4	-	2	3	-	1	-	-	-	-	-	-	-	1	2
5	1	2	2	-	2	-	-	-	-	-	-	-	1	2
6	1	2	3	-	3	-	-	-	-	-	-	-	1	2

Lab Activity:

SQL

1. Queries to facilitate acquaintance of Built-In Functions, String Functions, Numeric Functions, Date Functions and Conversion Functions.
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. Demonstrate PL/SQL Code using Basic Variable, Anchored Declarations, and Assignment Operation.
2. Demonstrate PL/SQL Code using Bind and Substitution Variables.
3. Demonstration of Printing in PL/SQL.
4. Demonstrate PL/SQL Code using SQL and Control Structures in PL/SQL.
5. Demonstrate PL/SQL Code using Cursors, Exceptions and Composite Data Types.
6. Demonstrate PL/SQL Code using Procedures, Functions, and Packages.

FORMS

1. Implementation of PL/SQL Code for Creation of forms for Information Systems such as Student Information System, Employee Information System etc.
2. Demonstration of database connectivity.

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

Suggested Reading:

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

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16CS C15

WEB TECHNOLOGIES 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 acquire knowledge of XHTML, Java Script and XML to develop webapplications.
2. Ability to develop dynamic web content using Java Servlets and JSP.
3. To understand JDBC connections and Java Mail API.
4. To understand the design and development process of a complete web applicationCourse.

Course Outcomes: On the successful completion of this course the student will be able to

1. Students will be able to develop static web sites using XHTML and Java Scripts.
2. To implement XML and XSLT for web applications.
3. Develop Dynamic web content using Java Servlets and JSP.
4. Use JDBC and web content using PHP.
5. Handle Sessions and use servlet filters in web applications.
6. Develop a dynamic web application using all the technologies learnt in the course.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	3	2	2	1	2	2	1	2	1	1
2	1	1	1	1	3	1	1	1	2	2	1	2	1	1
3	2	2	2	1	3	2	2	1	2	2	1	2	1	1
4	3	2	2	1	3	2	2	1	2	2	1	2	1	1
5	2	2	2	1	3	1	1	1	2	2		2		1
6	3	3	3	3	3	3	3	3	3	3	3	3	2	2

List of experiments:

1. Installation of web server and configuration of server and browser.
2. Create a web site using XHTML and CSS.
3. Demonstration of XML and XSLT.
4. Creation of dynamic content in a web site using JavaScript.
5. Form validation using JavaScript.
6. Creation of dynamic content in a web site using PHP.
7. Implementation of session tracking using PHP.
8. Creation of dynamic content in a web site using servlet and JSP.
9. Implementation of session tracking using servlet and JSP.
10. Database access through the web.
11. Develop a case study using PHP and MySQL. Creation of dynamic web site using all the above topics.

Text Books:

1. Internet & World Wide Web How to program - M. Deitel, P.J. Deitel, A. B. Goldberg 3rd Pearson Education
2. Programming the World Wide Web -Robert W. Sebesta, 4th Pearson Education

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16CS C16

COMPUTER ARCHITECTURE AND MICRO PROCESSORS 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 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 the successful completion of this course the student will be able to

1. Understand and apply the principles of Assembly Language Programming
2. Understand instruction formats and addressing modes of 8086.
3. Comprehend the instruction set of 8086.
4. Get familiarized with different assembly language software tools.
5. Interface various peripherals with microprocessor.
6. Apply the Micro Processor concepts on real-time applications.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	-	2	-	-	-	-	-	-	-	-	-	-	-
2	-	3	3	2	-	-	-	-	-	2	-	-	-	-
3	2	-	-	-	3	-	-	-	-	-	-	-	-	-
4	2	2	2	-	-	-	3	-	-	3	-	-	-	2
5	2	-	-	-	-	2	3	-	-	3	-	-	1	2
6	3	-	3	2	-	3	-	-	-	-	-	-	1	2

Prerequisites:

Digital Electronics and Logic Design, Computer Architecture.

List of Experiments:

1. Tutorials with 8086 kit / MASM software tool.
2. Fixed-point multiplication and division.
3. Floating-point multiplication and division.
4. Sorting hexadecimal array.
5. Code conversion from hexadecimal to decimal.
6. Sum of set of BCD numbers.
7. Searching.
8. Display a string of characters using 8279.
9. Interfacing traffic light controller using 8255.
10. Interfacing seven-segment LED using 8255.
11. Interfacing stepper motor using 8255.
12. Interfacing8253 counter.
13. D/A conversion using 8255.
14. A/D conversion using 8255.

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 Mc Graw Hill, Revised 2^{nd} Edition, 2007.
3. Brey 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.sss

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WITH EFFECT FROM ACADEMIC YEAR 2015-16

Syllabus of B.E. III YEAR
OF
FOUR YEAR DEGREE COURSE
IN

COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (Autonomous)
Hyderabad – 500 075

Chaitanya Bharathi Institute of Technology (AUTONOMOUS)

SCHEME OF INSTRUCTION & EXAMINATION
B.E. III - year
COMPUTER SCIENCE & ENGINEERING

SEMESTER-I

Sl.No	Syllabus Ref. No	SUBJECT	Scheme of Instructions: Periods per Week		Scheme of Examination			Credits
			L/T	D/P	Duration in Hrs.	Maximum Marks: Uni. Exam	Maximum Marks: Sessionals	
THEORY								
1	CS 311	Automata Languages and Computation	4	-	3	75	25	3
2	CS 312	Design and Analysis of Algorithms	4	-	3	75	25	3
3	CS 313	Embedded Systems	4	-	3	75	25	3
4	CS 314	Database Management Systems	4	-	3	75	25	3
5	CS 315	Operating Systems	4	-	3	75	25	3
6	CE 444	Human Values and Professional Ethics	2*	-	2	50	-	-
PRACTICALS								
6	CS 316	Embedded Systems Lab	-	3	3	50	25	2
7	CS 317	Database Management Systems Lab	-	3	3	50	25	2
8	CS 318	Operating Systems Lab	-	3	3	50	25	2
9	EG 221	Soft Skills and Employability Enhancement	-	2	2	50	25	1
		TOTAL	**22**	**11**	-	**625**	**225**	**22**

*21 Periods per semester

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Chaitanya Bharathi Institute of Technology (AUTONOMOUS)

SCHEME OF INSTRUCTION & EXAMINATION
B.E - III Year
COMPUTER SCIENCE & ENGINEERING

SEMESTER-II

	Syllabus Ref. No	SUBJECT	Scheme of Instructions: Periods per Week		Scheme of Examination			Credits
			L/T	D/P	Duration in Hrs.	Maximum Marks: Uni. Exam	Sessionals	
		THEORY						
1	CS 321	Compiler Construction	4	-	3	75	25	3
2	CS 322	Software Engineering	4	-	3	75	25	3
3	CS 323	Web Technologies	4	-	3	75	25	3
4	CS 324	Computer Networks	4	-	3	75	25	3
5		Elective-I	4	-	3	75	25	3
		PRACTICALS						
6	CS 326	Web Technologies Lab (Mini Project)	-	3	3	50	25	2
7	CS 327	Compiler Construction Lab	-	3	3	50	25	2
8	CS 328	Computer Networks Lab	-	3	3	50	25	2
9		Industrial Visit	-	14 Periods /Sem	-	-	-	-
		TOTAL	**20**	**9**	**-**	**525**	**200**	**21**

Elective-I:

CS 351 - Information Storage Management
CS 353 - Advanced Computer Architecture
CS 355 - Realtime Systems
CS 352 - Image Processing
CS 354 - Simulation and Modeling
CS 356 - Soft Computing

CS 311

AUTOMATA LANGUAGES AND COMPUTATION

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To introduce the students to the theoretical concepts of computer science
2. To know the various languages and grammars that are associated with various recognizers.
3. To understand the language by considering the idea of a decision problem
4. To understand language recognition problem and different classes of a problem

Course Outcomes:

1. Analyze the core concepts in automata theory and formal languages.
2. Design grammars and automata (recognizers) for different language classes.
3. Identify formal language classes and prove language membership properties.
4. Prove and disprove theorems establishing key properties of formal languages and computational models including (but not limited to) decidability and intractability.

UNIT-I

Automata: Introduction to Chomsky Hierarchy, Finite Automata, Central Concepts of Automata Theory. Finite Automata: An Informal Picture of Finite Automata, Deterministic Finite Automata, Non-deterministic Finite Automata, An Application, Finite Automata with Epsilon Transitions

UNIT-II

Regular expressions & Languages: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions.

Properties of Regular Languages: Proving Languages not to be Regular, Closure properties of Regular Languages, Decision Properties of Regular Languages, Decision Properties of Regular Language, Equivalence and Minimization of Automata.

UNIT-III

Context Free Grammars and Languages: Context free grammars, Parses Trees, Right Linear and Left Linear Grammars Applications, Ambiguity in Grammars and Languages. Pushdown Automata: Definition, Languages of PDA, Equivalence of PDA'sand CFG's Deterministic Pushdown Automata.**Properties of Context Free Languages:** Normal Forms for ContextFree Grammars, Pumping Lemma.

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UNIT-IV

Introduction to Turing Machines: Problems that Computers cannotSolve, The Turing machines, Programming Techniques for Turing Machines,Extensions to the Turing 4 Machines Restricted Turing Machines, Turingmachines and Computers.

UNIT-V

Un-decidability: A language that is not Recursively Enumerable, Anundecidable problem that is RE, Undecidable problems about TuringMachines, Post's Correspondence Problem, Other Undecidable Problems.**Intactable Problems:** The Classes P and NP, an NP Complete Problem, A Restricted Satisfiability problem.

Text Books:

1. John. E. Hopcroft, Rajeev Motwani, Jeffery, D. Ulman, "Introductionto Automata Theory, Languages and Computation", 3rd edition,Pearson Education-2007.
2. John C.Martin, "Introduction to Languages and the Theory ofComputation", 3rd edition Tata McGraw Hill, 2003.

Suggested Readings:

1. -Mishra and Chandrashekaran, "Theory of Computer Science – Automata languages and computation", 2nd edition, PHI.

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CS 312

DESIGN AND ANALYSIS OF ALGORITHMS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To provide an introduction to formalisms, understand, analyze and denote time complexities of algorithms.
2. To introduce the different algorithmic approaches for problem solving through numerous example problems.
3. To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness.

Course Outcomes:

1. Students will be able to develop an overall understanding of the performance of algorithms.
2. Students will be able to analyse and determine an algorithm's time complexity.
3. Students will be able to devise an appropriate algorithm for real world problem, using one of the algorithmic approaches.

UNIT-I

Introduction, Algorithm Specification, Performance analysis, SpaceComplexity, Time Complexity, Asymptotic Notation(O,Omega, Theta),Practical Complexities, Performance Measurement, Review of elementary data structures- Heap and Heap Sort, Hashing, Set representation: UNION and FIND.

UNIT-II

Divide-and Conquer: The general method, finding maximum and minimum, Merge sort, quick sort and selection. **Greedy Method:** Knapsack problem, Optimal Storage on tapes, Job sequencing with deadlines, Optimal merge patterns, Minimum Spanning Trees.

UNIT-III

Dynamic Programming And Traversal Techniques: Multistage graph, All Pair Shortest Paths, Optimal Binary Search trees,0/1 Knapsack, Reliability Design, Travelling Salesman Problem, BFS and Depth First Search: Applications of BFS and DFS. Bi-Connected components, transitive closure, topological sorting, strongly connected components.

UNIT-IV

Backtracking and Branch and Bound: 8-Queens Problem, Graph Coloring, Hamiltonian cycle, 0/1 Knapsack Problem, Traveling salesperson problem. Lower-Bound Theory.

UNIT-V

NP-Completeness: Basic concepts, Polynomial time, polynomial time verification, reducibility, **NP-complete problems:** The clique problem, the vertex-cover problem, the Hamiltonian cycle problem, the traveling salesman problem and the subset sum problem.

Text Books:

1. Horowitz E.,Sahani S, “Fundamentals of Computer Algorithms”,Galgotia Publications.
2. Cormen, Leiserson, Rivest,Stein, “Introduction to Algorithms”, Second Edition, PHI Learning.

Suggested Reading:

1. Aho, Hopcroft, Ulman, "The Design and Analysis of Computer Algorithms", Pearson Education, 2000.

CS 313

EMBEDDED SYSTEMS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. Emphasis on hardware and software in the design and development of Embedded Systems.
2. To study the principles and concepts of Embedded System architecture, hardware design and development.
3. The concepts and theory necessary to understand and program Distributed Embedded real-time systems.
4. The concepts of RTOS and various issues involved in Real Time Operating System.

Course Outcomes:

1. Analyze the core concepts of Embedded System and Embedded System Architecture.
2. Design and develop Embedded System hardware and software using Embedded C.
3. Analyze the operating system for Embedded Systems and Embedded System development environment.

UNIT – I

Introduction to Embedded Systems: Embedded Systems, Processor embedded into a system, Embedded hardware units and devices in a system, Embedded software in a system, Examples of embedded systems, Design process in Embedded system, Formalization of system design, Design process and design examples(smart card, digital camera, mobile phone), Classification of Embedded Systems, Skills required for embedded system designer.

UNIT-II

Programming concepts and Embedded programming in C: Software programming in Assembly language and in high level language C, C program elements: Header and source files, preprocessor directives, program elements, macros and functions, program elements: data types, data structures, modifiers, statements, loops and pointers.

Interprocess communication and synchronization of processes, Threads and Tasks.

Multiple processes in an application, Multiple threads in an application, Tasks , Task states, Task and data, Clear cut distinction between functions, ISRs and tasks and their characteristics.

Concept of semaphores, Shared data, Interprocess communication, Signal function, Semaphore functions, Message queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.

UNIT-III

Real time operating systems: OS services, Process management, Timer functions, Event functions, Memory management, Device, File, IO subsystems management, Interrupt routine in RTOS environment and handling of Interrupt source calls, RTOS, RTOS task scheduling models, Interrupt latency, Response of tasks as performance metrics, OS security issues.

UNIT-IV

8051 interfacing with displays (LED, 7 segment display, LCD), Switch, Relay , Buzzer, D/A and A/D converters, Stepper motor.

Real time OS programming-I: Micro C/OS –II and Vx works, Basic functions and types of RTOSes, RTOS Micro COS-II, RTOS Vxworks, Basic features.

Networked Embedded systems, Serial communication protocols , I2C bus, CAN bus, RS232, Introduction to advanced architectures: ARM and SHARC .

UNIT-V

Embedded software Development process tools: Introduction to embedded software development process and tools, Host and Target machines, Linking and locating software, Getting embedded software into target system, Issues in hardware - software design and Co-design.

Testing, simulation and debugging techniques and tools: Testing on host machine, Simulators, Laboratory tools

Text Books:

1. Raj Kamal, "Embedded Systems: Architecture, Programming And Design", Second Edition 2008, The McGraw-Hill Companies.

Suggested Reading:

1. David E. Simon, "An Embedded Software Primer", Pearson Education, 1999.
2. Wayne Wolf , "Computers as Components: Principles of Embedded Computing System Design", Elsevier, 2008.

CS 314

DATABASE MANAGEMENT SYSTEMS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To 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:

1. Students will be able to develop the knowledge of fundamental concepts of database management
2. Students will be able to apply the concepts like data storage and indexing.
3. Students will be able to implement the knowledge about transaction management, concurrency control and recovery of database systems.

UNIT-I

Introduction : Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Specialty Databases, Data Storage and Querying, 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, Other Aspects of Database Design.

UNIT-II

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

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, Nested Sub queries, Views, Join Expression. Triggers, Index Definition in SQL, Procedures and Functions in SQL, Recursive Queries, JDBC,ODBC, Embedded SQL.

UNIT-III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Basic Definitions, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Non-loss Decomposition and Functional Dependencies, Normalization – 1NF,

2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF, Multi-valued Dependencies and 4NF, Join Dependencies and 5NF.
Indexing: Overview of Indexes, Properties of Indexes, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files, Bitmap Indices.

UNIT-IV
Hashing: Static Hashing, Dynamic Hashing - Extendible Hashing, Linear 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, Performance of Lock-Based Concurrency Control, Specialized Locking Techniques - Dynamic Databases and the Phantom Problem.
Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, 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", 8th Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, JohnnesGehrke, "Database Management Systems" ,Third Edition, McGraw Hill,2003.
2. RamezElmasri, Durvasul V L N Somayazulu, Shamkant B Navathe, Shyam K Gupta, "Fundamentals of Database Systems", Fourth Edition, Pearson Education,2006.

CS 315

OPERATING SYSTEMS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To understand the services an operating system provides to users, processes and other systems
2. To understand how to manage various resources like CPU, Memory, Files and I/O.
3. To understand Process Synchronization, multiprogramming, Deadlocks.
4. To understand the Architecture and implementation of different operating systems.

Course Outcomes:

1. Students will be able to develop the knowledge of the role of operating system and its design.
2. Students will be able to implement the knowledge of multiprogramming, multithreading, deadlocks.
3. Students will be able to analyse the concept of IPC
4. Students will be able to realize the concept of I/O, file management and possess the knowledge about new evolving operating systems and their features.

UNIT-I

Introduction: What Operating Systems Do, Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations

Operating-System Structures: Operating-System Services, User Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation Operating-System Structure, Virtual Machines, Operating-System Debugging Operating-System Generation System Boot.

UNIT-II

Process Management: Processes, Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication, Examples of IPC Systems , Communication in Client – Server Systems.

Threads Overview, Multithreading Models, Threading Issues

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms,Thread Scheduling, Multiple-Processor Scheduling.

Process Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization , Synchronization Examples , Atomic Transactions.

UNIT-III

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

MEMORY MANAGEMENT: Main Memory, Background, Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation.

Virtual Memory: Background, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory.

UNIT-IV

File-System Interface: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection

File-System Implementation: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance Recovery.

Mass-Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure, Stable-Storage Implementation, Tertiary-Storage Structure

UNIT-V

I/O Systems: Overview, I/O Hardware, Application I/O Interface, Transforming I/O Requests to Hardware Operations

Protection and Security: Protection, Goals of Protection, Principles of Protection , Domain of Protection,Access Matrix, Implementation of Access Matrix, Access Control , Revocation of Access Rights, Capability-Based Systems , Language-Based Protection

Security: The Security Problem , Program Threats, System and Network Threats, Cryptography as a Security Tool, User Authentication , Implementing Security Defenses , Firewalling to Protect Systems and Networks, Computer-Security Classifications

Text Books:

1. Avi Silberchatz, Peter B. Galvin, Greg Gagne, "Operating System-Concepts", John Wiley & sons, Eighth Edition, 2008
2. Andrew S.Tanenbaum, "Modern Operating Systems", Third Edition, Pearson education, Asia-2008

Suggested Reading:

1. W.Richard Stevens; Stephen A.Rago, "Advanced Programming in the UNIX Environment", Third Edition, Addison-Wesley professional Publication Date:14-MAY-2013

CE 444

HUMAN VALUES AND PROFESSIONAL ETHICS

Instruction	21L Periods per semester (7 * 3)
Duration of University Examination	2 Hours
University Examination	50 Marks
Sessionals	-
Credits	-

Course Objectives:

1. To develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. To enable the students understand the values, the need for value adoption and prepare them meet the challenges
3. To enable the students develop the potential to adopt values, develop a good character and personality and lead a happy life
4. To motivate the students practice the values in life and contribute for the society around them and for the development of the institutions /organization around they are in.
5. To make the students understand the professional ethics and their applications to engineering profession

Course Outcomes:

1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, convert everything into happiness and contribute for the happiness of others.
4. Students become potential sources for contributing to the development of the society around them and institutions / organisations they work in.
5. Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

UNIT-I

Concepts and Classification of Values –Need and challenges for value Adoption Definition of Values – Concept of Values – Classification of Values – Hierarchy of Values – Types of values –Espoused and Applied Values – Value judgement based on Culture – Value judgement based on Tradition – Interdependence of Values.

Need for value education – Findings of Commissions and Committees - Corruption and illegal practices – Science and Technology without values- Exploitation of nature – Increasing use of violence and intoxicants – Lack of education in values – Implications of education in values – Vision for a better India.

Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges.

UNIT-II

Personal Development and Values in Life

Personal Development: Enlightened self-interest – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity – The quest for Character – Tests of Character – The key to good character.
Values in Life: Building an ethical policy – Integrating values in everyday life – Archaic Social Values – Parenting practices – Critical Thinking - Analyzing and Prioritizing values – Practicing Yoga and Meditation

UNIT-III
Practicing Values for the development of Society
Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atrocities – Environmental awareness – Working for the Sustainable development of the society.
Values in Education system: Present Scenario- Engineering education –Current trends- Need for quality improvement- Adoption of value education – Principles of Integrity-Institutional Development.

UNIT-IV
Basic Concepts of Professional Ethics
Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional ethics, Ethical dilemmas, Indian and Global thoughts on ethics, Profession, Professional and Professionalism, Ethical role of a professional Basic ethical principles, Some basic ethical theories, use of ethical theories.
Science, Religion Ethics, Genders and ethics, Media and ethics, Computer Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities

UNIT-V
Ethics in engineering profession
Engineering profession-Technology and Society-Engineering as Social Experimentation-Engineering ethics-Ethical obligations of Engineering Professionals-Role of Engineers-Engineers as Managers-Professional responsibilities of Engineers- Engineers Responsibility for Safety- A few Case Studies on Risk management
Conflicts of Interest- Occupational Crimes- Plagiarism-Self plagiarism-Ethics Audit-Consideration for ethics audit-Ethics Standards and Bench Marking

Text Books:

1. Subramanian R., “Professional Ethics” , Oxford University Press , 2013
2. Nagarajan R.S., “A Text Book on Human Values and Professional Ethics” New Age Publications, 2007
3. Dinesh Babu S., “Professional Ethics and Human Values” , Laxmi Publications , 2007

Suggested Readings:

1. Santosh Ajmera and Nanda Kishore Reddy “Ethics, Integrity and Aptitude”, McGrawhill Education Private Limited , 2014
2. Govinda Rajan M., Natarajan S., Senthil Kumar V.S. ”Professional Ethics and Human Values“ Prentice Hall India Private Limited, 2012
3. Course Material for Post Graduate Diploma In “Value Education & Spirituality” Prepared by Annamalai University in Collaboration with Brahma Kumaris, 2010

CS 316

EMBEDDED SYSTEMS LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. Understanding of Embedded Systems and learn programming in Embedded C.
2. To analyze and design various Microcontroller applications and interfacing.
3. Understanding and analyzing RTOS characteristics.
4. To learn how to write simple applications using RTOS.

Course Outcomes:

1. Apply knowledge of 8051 microcontroller and interface with various devices.
2. Demonstrate serial communication using IIC protocol.
3. Develop RTOS programs to implement various applications.
4. Learn to integrate hardware and software to come up with an Embedded System.

Using 8 bit microcontroller, following programs have to be tested on 89C51 Development board/equivalent using Embedded C Language on RIDE IDE and Proload or Equivalent.

A) Interface Input, Output and other units such as: Relays, LEDs, LCDs, Switches, Keypads, Stepper Motor, Sensors, ADC, DAC, Timers:

1. Program to interface a Leds, Buzzer and Switch to different pins of a Port such that the buzzer and leds should work as long as the switch is pressed.
2. Program to interface relay
3. Program to interface LCD in four bit mode and 8 bit mode to display message on it.
4. Program to interface Seven Segment display unit.
5. Program to interface Stepper Motor to rotate the motor in clockwise and anticlockwise directions.
6. Program to illustrate timer interrupt.
7. Program to implement Analog to Digital conversion using ADC0808 and Digital to Analog conversion using DAC0808.

B) Demonstrate Communications using IIC protocol:

8. Program to interface Real Time Clock and EEPROM using software implemented IIC protocol

RTOS: Understanding Real Time Concepts using any RTOS through demonstration of:

9. Program to create Tasks.
10. Program to illustrate producer consumer problem using Semaphores.
11. Program to illustrate Queues.
12. Program to illustrate Timer.

Suggested Readings:

1. Wayne Wolf , “Computers as Components: Principles of Embedded Computing System Design”, Elsevier, 2008.

CS 317

DATABASE MANAGEMENT SYSTEMS LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1 To familiar with the concepts of structured query language.
2 To understand about programming language/ structured query language (PL/SQL).
3 To familiar with generation of form and open database connectivity.

Course Outcomes:

1 Students will be able to develop the knowledge of structured query language concepts.
2 Students will be able to Implement the concepts of PL/SQL.
3 Students will be able to design GUI using forms and implement database connectivity.

List of Experiments:

SQL

1. Queries to facilitate acquaintance of Built-In Functions, String Functions, Numeric Functions, Date Functions and Conversion Functions.
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

10. Write a PL/SQL Code using Basic Variable, Anchored Declarations, and Usage of Assignment Operation
11. Write a PL/SQL Code Bind and Substitution Variables.
    Printing in PL/SQL
12. Write a PL/SQL block using SQL and Control Structures in PL/SQL
13. Write a PL/SQL Code using Cursors, Exceptionsand Composite Data Types
14. Write a PL/SQL Code using Procedures, Functions, and Packages

FORMS

15. Write a PL/SQL Code Creation of forms for any Information System such as Student Information System, Employee Information System etc.

16. Demonstration of database connectivity

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, "Database Systems Using Oracle", PHI,2007.
3. Rick F Van der Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007.

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CS 318

OPERATING SYSTEMS LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. To understand the design aspects of operating system.
2. To design and apply the process management concepts.
3. To design and apply the storage management concepts.

Course Outcome:

1. Students will be able to use Unix utilities and perform basic shell control of the utilities
2. Students will be able to use the Unix file system and file access control.
3. Students will be able to write programs systems based on multiple cooperating processes or threads
4. Students will be able to implement process scheduling, synchronization and memory management algorithms.

List of experiments:

1. Programs using LINUX shell scripts.
2. Programs using process related system calls.
3. Programs to illustrate threads
4. Implement CPU scheduling algorithms (a) Round Robin (b) SJF (c) FCFS
5. Echo server using pipes
6. Echo server using messages
7. Producer- Consumer problem using shared memory.
8. Dining philosopher problem using semaphore
9. Implement page replacement algorithms (a) FIFO (b) LRU
10. Bankers algorithm for Deadlock detection and avoidance
11. Programs to illustrate different file related System calls.
12. Printing file flags for specified descriptor.

Suggested Reading:

1. Deitel and Deitel, “Operating System”, Pearson Education, New Delhi, Third Edition, 2007.

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EG 221

SOFT SKILLS AND EMPLOYABILITY ENHANCEMENT

Instruction	2 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	1

Course Objectives: To help the students

1. Participate in group discussions with confidence and to make effective presentations. Also to learn the art of communication.
2. With-resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management & goal setting, self confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.

Course Outcomes: Student will be able to

1. Be effective communicators and participate in group discussions 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.

Exercise 1

Communicative Competence –The Art of Communication, basic grammar, Indianisms, Effective listening skills, using English in different situations

Exercise 2

Group Discussion –dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence

Elements of effective presentation –Structure of presentation –Presentation tools –Body language Creating an effective PPT

Exercise 3

Interview Skills –Resume' writing –structure and presentation, planning, defining the career objective, projecting ones strengths and skill – sets Interview Skills –concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

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Exercise 4

Personality Development –Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.

Exercise 5

Corporate Culture –Grooming and etiquette, communication media etiquette Academic ethics and integrity

Text Books/Suggested Reading:

1. Madhavi Apte , "A Course in English communication", Prentice - Hall of India, 2007
2. LeenaSen , "Communication Skills", Prentice Hall of India, 2005
3. Dr. Shalini Verma, "Body Language - Your Success Mantra", S Chand, 2006
4. Edgar Thorpe and Showick Thorpe , "Objective English", 2nd edition, Pearson Education, 2007
5. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010
6. Gulati and Sarvesh, " Corporate Soft Skills", New Delhi: Rupa and Co. , 2006
7. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004
8. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989.

II-SEMESTER

CS 321

COMPILER CONSTRUCTION

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives :

1. To implement the concept learned in automata theory and languages to the field of Computer Science.
2. To understand the processes involved in converting a source language to target code
3. To expose the students to the analysis and synthesis phases of compilation
4. To build a compiler at the end of the course

Course Outcomes:

1. Design & implement a software system for the compiler.
2. Deal with different translators.
3. Apply the knowledge of lex tool &yacc tool to develop a scanner & parser.
4. Design & conduct experiments for analysis and synthesis phases of compilation.

UNIT-I

Introduction – Programs related to compilers. Translation process.Majordata structures.Other issues in compiler structure. Boot strapping andporting.**Lexical analysis** – The role of Lexical Analyzer.Input Buffering.Specification of Tokens.Recognition of Tokens.The Lexical-AnalyzerGenerator Lex.

UNIT-II

Syntax Analysis – Introduction. Top-Down parsing, Brute Forcing,Recursive Descent, Predicative LL(1), Bottom-Up parsing : Introductionto LR Parsing, Powerful LR parsers SLR, CALR, LALR, UsingAmbiguous Grammars, Parser Generators - Yacc.

UNIT-III

Syntax Directed Translation – Syntax Directed Definitions. EvaluationOrders for SDDs. Applications of Syntax Directed Translation.

Symbol Table Organization - Structure of Symbol table, Symbol Tableorganization for Block Structured and non-block Structure languages, Data
Structures of symbol Table.

UNIT-IV

Intermediate code generation : Variants of syntax trees. Three-AddressCode, Types and Declarations.Translation of Expressions.Type Checking.Control Flow.

Storage Organization. Stack Allocation of Space. Access to Non localData on the Stack.Heap Management.Introduction to GarbageCollection.

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UNIT-V

Code Generation – Issues in the Design of a Code Generator.TheTarget Language. Addresses in the Target Code Basic Blocks and FlowGraphs. Optimization of Basic Blocks.Peephole Optimization. RegisterAllocation and Assignment. Machine Independent Optimizations – ThePrincipal Sources of Optimizations, Introduction to data flow analysis,Foundation of data flow analysis.

Error Recovery : Introduction, Error detecting and Reporting in variousPhases, Lexical Errors, Syntax Errors handling, and error Recovery invarious Phases.

Text Books:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, “Compilers: Principles Techniques & Tools”, Pearson Education2nd Edition 2007.
2. Keith D Cooper & Linda Tarezon, “Engineering a Compiler”, MorganKafman, Second edition.Lex&Yacc, John R Levine, Tony Mason, Doug Brown, ShroffPublishers.

Suggested Reading:

1. Kenneth C Louden, “Compiler Construction: Principles andPractice”, Cengage Learning. Lex&Yacc, John R Levine, Oreilly Publishers.

CS 322

SOFTWARE ENGINEERING

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To familiarize students with software development process.
2. To learn software quality assessment.
3. To learn testing for optimum functionality at reasonable cost.
4. To understand the merits and demerits of different approaches in software engineering.

Course Outcomes:

After completion of this course, student will be able to

1. Analyze various software engineering models and patterns generally used.
2. Choose the best model for the project based on the type of project.
3. Perform quality assessment testing on the software and measure the quality using various metrics.
4. Perform testing through various techniques to make sure the software project is optimal and to achieve this at a reasonable cost.

UNIT –I

Introduction to Software Engineering: Theevolvingrole of Software, changing nature of Software, Software Myths .

Generic view of Process: Software Engineering, Process Framework, CMMI, Process Patterns, Process Assessment, Personal and Team Process, Process Technology, Product and process.

Process Models: Perspective Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Process.

An Agile View of Process: What is Agility, Agile Process, and Agile Process Models.

UNIT-II

Requirement Engineering: A bridge to design and construction, Requirement Engineering tasks, Initiating Requirement Engineering Process, Eliciting Requirement, Developing Uses cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

Planning and Managing the Project: Tracking Progress, Project Personnel, Effort Estimation, Risk Management, the Project Plan, Process Models and Project Management.

UNIT-III

Building the Analysis and Design Model: Requirements Analysis Modeling approaches, Data modeling concepts, Object oriented analysis , Scenario based modeling, Flow oriented modeling, Class-based modeling, Creating a Behavioral Modeling. Design within the context of SE, Design Process and Design quality, Design concepts, The Design Model, Pattern-based Software Design.

Creating Architectural Design: Software architecture, Data design, Architectural Styles and Patterns, Architectural Design.

UNIT-IV

Modeling Component-Level Design: What is a Component, Designing Class-Based components, Conducting Component–level Design, Object Constraint Language, Designing Conventional Components.

Performing User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

Implementation: Coding Principles and Standards, Coding Process, Code Verification .

UNIT-V

Testing Strategies: A Strategic approach to software testing, strategic issues, test strategies for O-O software, validation testing, system testing, art of debugging.

Testing Tactics: Software Testing Fundamentals, Black-Box and white box Testing, basis path testing, Control Structure Testing, O-O Testing methods.

Product Metrics: Software quality, A framework for product metrics, Metrics for the analysis model, metrics for the Design model, metrics for source code, Metrics for Testing.

Software Maintenance: Categories of Maintenance, Maintenance Process models,Software reuse, Metrics for maintenance.

Text Books:

1. Roger S. Pressman, "Software Engineering –A Practitioners Approach", 7th Edition, Pearson Education, India, 2010.
2. Shari Lawrence Pfleeger, "Software Engineering Theory and Practices" 4th Edition - Pearson Education, India, 2011.

Suggested Reading:

1. UgrasenSuman"Software Engineering concepts and Practices", Cengage Learning,2013.

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CS 323

WEB TECHNOLOGIES

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To acquire knowledge ofXHTML,Java Script and XML to develop web applications
2. Ability to develop dynamic web content using Java Servlets and JSP
3. To understand JDBC connections and Java Mail API
4. To understand the design and development process of a complete web application

Course Outcomes:

1. Students will be able to develop static web sites using XHTML and Java Scripts
2. To implement XML and XSLT for web applications
3. Develop Dynamic web content using Java Servlets and JSP
4. To develop JDBC connections and implement a complete Dynamic 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, Basics of JavaScript

UNIT-II

Event handling and Dynamic Documentation with Java Scripts

Introduction to XML, XML document structure, DTD, namespaces, Schemas. XSLT style sheets, XML Processors.

UNIT-III

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.

Introduction to Web containers: Web Application Structure, Mapping requests to Applications and Servlets, Securing web Applications and Deployment configuration

Servlet Sessions, Context and Collaboration: Approaches to Session tracking, Session Tracking with java servlet API, Servlet Context, Servlet Collaboration.

UNIT-IV

Filters for web applications: Introduction to filters, filter API, Deployment descriptor for filters, chat applications with filters.

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, Application Life Cycle Events.

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UNIT-V

Java Database Connection: Introduction to JDBC, Database Drivers, Interfaces and classes of java.sql package. Retrieving Meta information from database and ResultSet, JDBC Data Sources, Connection pooling, Distributed transactions and RowSet objects.

Java Mail: Mail Protocols, Overview, Installation and Configuration,API ,Working with Mail and Resources.

Text Books:

1 SubramanyamAllamraju, “Professional Java Server programming”, J2EE 1.3 Edition, CeditBuest, Apress Publications.
2 Robert W Sebesta, “Programming the World Wide Web”, Pearson Education

Suggested Reading:

1. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2010.

CS 324

COMPUTER NETWORKS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. Understanding the concepts of network reference models
2. Analysis of Routing algorithms and congestion algorithms
3. Functionality of the transport layer
4. Basics of cryptography and different application layer protocols

Course Outcomes:

After completion of this course, student will be able to

1. Deter main the ISO-OSI and TCP/IP Models
2. Design applications using internet protocols
3. Implement routing and congestion control algorithms
4. Develop application layer protocols

UNIT-I

Introduction: Network Architecture, Protocol implementation issues, Quantitative performance metrics, Network Design, Reference Models- ISO-OSI and TCP/IP, Comparison of the OSI and TCP/IP models.

UNIT-II

Network Layer: Network layer design issues, Routing Algorithms, Congestion Control Algorithms

Internetworking: The network layer in the internet, Internet Protocol (IP), Unicast, Multicast, and inter Domain Routing, QOS in IP.

UNIT-III

Transport Layer: Elements of transport Protocol, Congestion Control, Performance issues, Transmission Control Protocol (TCP), Remote Procedure Call (RPC)- Implementation semantics of RPC, Client server applications. Real-time Transport Protocol (RTP), Multimedia applications, Congestion control and resource allocation, congestion control in TCP and UDP.

UNIT-IV

Application Layer: Domain Name Server, World Wide Web- HTTP, Presentation formatting and Data Compression, Network Security- Cryptographic tools, the problems of key distribution, General Authentication techniques, PGP, SSH, IPSEC and Firewalls

UNIT-V

Network Application and Protocols: File Transfer Protocol, email and the Web, Multimedia applications such as IP telephony, Video streaming, Overlay Networks like peer-to-peer file sharing and Content Distribution Networks (CDN), Web Services architectures for developing new application protocols

Text Books:

1. Larry L Peterson, Bruce S Davis, "Computer Networks", 5th Edition, Elsevier, 2012.
2. Andrew S. Tannenbaum, David Wetherall "Computer Networks", 5th Edition, Pearson Edu, 2010.

Suggested Reading:

1. Forouzon, "Computer Networks and communication – Top down Approach", 5thEdition, 2013.

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CS 351

INFORMATION STORAGE AND MANAGEMENT

(Elective – I)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course objectives:

1. Evaluate storage architectures; understand logical and physical components of a storage infrastructure including storage subsystems, RAID and intelligent storage systems.
2. Describe networking technologies such as FC-SAN,NAS, IP-SAN and data archival solution - CAS.
3. Identify different storage virtualization technologies, backup technologies and their benefits.
4. Understand and articulate business continuity solutions including, backup technologies, and local and remote replication solutions, information security, and storage security domains.

Course Outcomes:

1. Describe and apply storage technologies.
2. Identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centers.
3. Describe important storage technologies, features such as availability, replication, scalability and performance.
4. Manage virtual servers and storage between remote locations, design, analyze and manage clusters of resources, desing, analyze and manage clusters of resources.

UNIT-I

Storage System: Introduction to information storage, virtualization and cloud computing, Key data center elements, Compute, application, and storage virtualization, Disk drive & flash drive compnents and performance, RAID, Intelligent storage system and storage provisioning (including virtual provisioning).

UNIT-II

Storage Networking: Fibre Channel SAN components, FC protocol and operation, Block level storage virtualization, iSCSI and FCIP as an IP-SAN solutions, Converged networking option – FcoE, Network Attached Storage (NAS) – components, protocol and operation, File level storage virtualization, Object based storage and unified storage platform.

UNIT-III

Backup, Replication, Archive: Business continuity terminologies, planning and solutions, Clustering and multi-pathing architecture to avoid single points of failure, Backup and recovery – methods, targets and topologies, Data de-duplication and backup in virtualized environment, Fixed content and data archive, Local replication in classic and virtual environments, Remote

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replication in classic and virtual environments, Three-site remote replication and continuous data protection.

UNIT-IV

Cloud Infrastructure: Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits, Cloud Service Models, Deployment Models, Cloud Computing Infrastructure, Cloud Challenges, Cloud Adoption Consideration, Concepts in practice.

UNIT-V

Storage Security & Management: Security threats, and countermeasures in various domains, Security solutions for FC-SAN, IP-SAN and NAS environments, Security in virtualized and cloud environments, Monitoring and managing various information infrastructure components in classic and virtual environments, information lifecycle management(ILM) and storage tiering.

Case Study:

1. Technologies described in the course are reinforced with BROCADE & EMC examples of actual solutions.
2. Realistic case studies enable the participants to design the most appropriate solution for given sets of criteria.

Text Books:

1. EMC Corporation, “Information Storage and Management”, Second Edition, Wiley Publishers.
2. John W. Rittinghouse, “Implementation Management and Security”, James F. Ransome, CRC Press.

Suggested Reading:

1. Robert Spalding, “Storage Networks: The Complete Reference”, Tata McGraw Hill, Osborne, 2003.
2. Marc Farley, “Building Storage Networks”, Tata McGraw Hill, Osborne, 2001.
3. Meeta Gupta, “Storage Area Network Fundamentals”, Rearson Education Limited, 2002.

CS 352

IMAGE PROCESSING
(Elective – I)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:
1. To gain the fundamentals of digital image processing.
2. To provide mathematical foundations for digital manipulation of images; image acquisition; preprocessing; segmentation; Fourier domain processing; and compression.
3. To be able to formulate solutions to general image processing problems,

Course Outcomes:
1. Student will learn the mathematics behind the image processing
2. Student will be able to understands the significance of image processing and will be able to solve the problems in image processing

UNIT-I
Introduction to Digital Image Processing: Origins and Applications of Digital Image Processing. Fundamental Steps in Digital Image Processing, Components of Digital Image Processing System. Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization.

UNIT-II
Filtering in the Frequency Domain: Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform (DFT) of One Variable, Extension to Function of Two Variables, Image Smoothing and Sharpening using Frequency Domain Filters.

UNIT-III
Filtering Intensity Transformations and Spatial: Histogram Processing, Fundamental of Spatial Filtering, Smoothing and Sharpening Spatial Filters.
Image Segmentation: Point, Line and Edge Detection, Thresholding-(Foundation, Basic global thresholding, Otsus method), Region-Based Segmentation.

UNIT-IV
Image Compression: Fidelity Criteria, Image Compression Models, Image Formats, Containers and Compression Standards.
Compression Methods: Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-Length Coding.

UNIT-V
Restoration: Noise Models, Inverse filtering. Least squares Filtering.

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Color Image Processing: Color fundamentals, Color models, Pseudocolor Image Processing, Basics of full color image processing.

Text Books:

1. Gonzalez R.C., Woods R.E**:** Digital Image Processing, Pearson Education, third edition 2012.
2. William K. Pratt,” Digital Image Processing”,John Wiley & Sons Inc.Edition,2001.

Suggested Reading:

1. McAndrew, Introduction to Digital Image Processing, Cengage Learning 2004.
2. Sonka, Hlavac, Boyle, Digital Image Processingand Computer vision, Cengage learning, 2008.
3. Rosenfeld A. Kak AC: Digital Picture Processing Vol.I & II Acad,Press,2nd Edition , 1982.

CS 353

ADVANCED COMPUTER ARCHITECTURE
(Elective – I)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course objectives:
1. To describe computational models and learn the fundamental aspects of computer architecture design
2. Understand advanced issues in design of computer processors, caches, and memory.
3. Analyze performance trade-offs in computer design.
4. Understand pipelining, instruction set architectures and Multi-Threaded Architectures
5. To acquaint the student with various classes of computers, and new trends and developments in computer architecture

Course Outcomes:
1. Understand the advanced concepts of computer architecture
2. Apply knowledge of processor design to improve performance in algorithms and software systems.
3. Investigate modern design structures of Pipelined Processors and Multiprocessor Systems
4. Become acquainted with recent computer architectures and I/O devices
5. Gain knowledge of Semiconductor technology, Interconnection technology, Optical computing, Bio-electronic computing and future directions.

UNIT-I

Computational models: The concept of a computational model, Basic computational models, The von Neumann computational model, Key concepts relating to computational models.

The concept of Computer Architecture: Evaluation and interpretation, Interpretation of the concept of computer architectures at different levels of abstraction, as a multilevel hierarchical framework, Extensions and description of computer architectures.

Introduction to Parallel Processing: Basic concepts, Types and levels of parallelism, classification of parallel architectures, basic parallel techniques, Relationships between languages and parallel architectures.

Introduction to ILP-Processors: Evaluation and overview of ILP-Processors, Dependencies between instructions, Instruction scheduling, preserving sequential consistency, the speed-up potential of ILP-Processing.

Pipelined Processors: Basic concepts ,Design space of pipelines, Overview of pipelined instruction processing, Pipelined execution of integer and Boolean instructions, Pipelined processing of loads and stores.

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UNIT-II

VLIW Architectures: Basic Principles, Overview of proposed and commercial VLIW architectures, Case study: The Trace 200 family.

Superscalar Processors: Processing of Control Transfer Instructions introduction, Basic approaches to branch handling, Delayed branching, Branch processing, Multiway branching, Guarded execution.

Code Scheduling for ILP-Processors: Introduction, Basic block scheduling, Loop scheduling,Global scheduling.

UNIT-III

Introduction to Data-Parallel Architectures: Introduction, connectivity, Alternative architectural classes.

SIMD Architectures : Introduction, design space, Fine-grained SIMD architectures, Coarse-grained SIMD architectures.

Associative and Neural Architectures: Introduction, Associative Processing-An example: the associative string processor, Application array mapping, Neural computers.

UNIT-IV

Data: Parallel Pipelined and Systolic Architectures: Introduction, Pipelines, Systolic architectures.

Vector Architectures: Introduction, word length, vectorization, pipelining, parallel computing streams, technology-the Cray family, The Convex C4/XA system.

Introduction to MIMD Architectures: Architectural concepts,Problems of scalable computers,Main design issues of scalable MIMD computers.

UNIT-V

Multi-threaded Architectures: Introduction, computational models, von Neumann-based multi threaded architectures, dataflow architectures, Hybrid multi-threaded architectures, distributed Memory MIMD Architectures: Introduction, direct interconnection networks, Fine-grain systems, Medium-grain systems, Coarse-grain multi-computers.

Shared Memory MIMD Architectures: Introduction, Dynamic interconnection networks, Cache coherence, Synchronization and event ordering in multi-processors, UMA, NUMA, CC_NUMA, COMA machines.

Outlook: Introduction, Semiconductor technology, Interconnection technology, Optical computing, Bio-electronic computing, future directions.

Text Books:

1. Sima, Fountain, Kacsuk, “Advanced Computer Architectures: A design space approach”, Pearson Education,2004.
2. Richard Y.Kain, “Advanced Computer Architectures: A Systems design approach”,Prentice Hall India,2005.
3. David E.Culler, Jaswinder Pal Singh and Anoop Gupta, “Parallel computer Architecture:A hardware software approach”, Morgan kaufmann publishers, 2009.

Suggested Reading:

1. Kai Hwang, “Advanced Computer Architecture”, Mc Graw Hill, 1999.
2. John L.Hennessy & David A Patterson,”Computer Architectures A Quantitative Approach”, Morgan Kaufmann Publishers, Inc, 1996.

CS 354

SIMULATION AND MODELING

(Elective – I)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. Introduce computer simulation technologies and techniques, provides the foundations for the student to understand computer simulation needs, and to implement and test a variety of simulation and data analysis libraries and programs. This course focuses what is needed to build simulation software environments, and not just building simulations using preexisting packages.
2. The goal is to introduce students to basic simulation methods and tools for modeling and simulation of continuous, discrete and combined systems.
3. Introduce concepts of modeling layers of society's critical infrastructure networks.
4. Build tools to view and control simulations and their results.

Course Outcomes:

Students will be exposed to the details of modeling and simulation technologies. They will cover the following:

1. Basic Model Forms,Simulation Approaches
2. Handling Stepped and Event-based Time in Simulations
3. Discrete versus Continuous Modeling
4. Numerical Techniques
5. Sources and Propagation of Error
6. By the end of the course students will be able to apply the fundamental laws of performance analysis to establish the relationships between workload parameters and system performance for a given system.

UNIT-I

Introduction to Simulation: Advantages and Disadvantages of simulation, Areas of application, System and System Environment, Components of a System, Discrete And Continuous Systems, Model of a System ,Types of Models ,Discrete-Event System Simulation, Steps in a Simulation Study, Simulation Examples.

UNIT-II

Overview of Statistical models and queuing systems: Programming languages for simulation, Continuous and discrete simulation languages-FOTTRAN, GPSS, SIMAN, SIMSCRIPT, SLAM and MODSIM III

UNIT-III

Random Numbers: generation, properties of random numbers, generation of pseudo-random numbers, tests for random numbers, Random variate: generation, inverse transformation technique, uniform distribution, exponential distribution. Weibul’s distribution, triangular

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distributions, direct transformation for the normal distribution, convolution method of Erlang distribution, Acceptance rejection techniques: Poisson distribution, Gamma distribution.

UNIT-IV

Input data analysis: Data Collection, Identify the distribution, parameter and estimation. Goodness of fit tests: Chi square test- KS test, Multivariate and time series input models, Verification and validations of simulation models, Model building, **verification and validation:** Verification of simulation models, calibration and validation of models face validity, Validation of model assumptions, validation input/output Transformations, Input/output validation using historical input data, Input/output validation using Turning test.

UNIT-V

Output data analysis, stochastic nature of output data, Types of simulation with respect to output analysis. Measures of performance and their estimation, Output analysis for terminating simulations, Output analysis for steady-state simulations, Comparision and evaluation of alternative system designs: Comparison of several system designs. Statistical models for estimating the effect of design alternatives.

Text Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, and David M. Nicol. Discrete-Event System Simulation, Pearson Education Asia, 2001.
2. Narsingh Deo, System Simulation with Digital Computers, Prentice Hall of India, 1979.

Suggesting Reading:

1. Anerill M Law and W. David Kelton, Simulation Modeling and Analysis, McGraw Hill, 2009.

CS 355

REAL TIME SYSTEMS
(Elective – I)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:
1. Define Real Time systems and differentiate between hard and soft realtime systems
2. Study applications of realtime systems
3. Get a theoretical understanding of realtime aspects of computing in terms of scheduling, timing and concurrency
4. Know specific design and implementation aspects of realtime systems
5. Understand capabilities of RealTime operating systems like Vx Works and RT Linux

Course Outcomes:
1. Understand the fundamental concepts of real-time systems.
2. Gain theoretical and practical knowledge of real-time operating systems
3. Understand capabilities of commercial off-the-shelf R-T kernel

UNIT-I
Introduction: Definition, Applications and Types of Real Time Systems, Typical Case Studies of Real Time Systems, Timing Constraints.
A Reference Model for Real Time Systems: Processors and Resources, Periodic Task Model, Precedence and Data Dependency, Temporal, Functional and Resource parameters, Scheduling Hierarchy.

UNIT-II
Real Time Scheduling: Different Approaches – Clock Driven, Priority Driven, Scheduling of Periodic, Aperiodic and Sporadic Jobs in Priority Driven Systems.

UNIT-III
Resource Management: Resources and Resource Access Control, Critical Section, Priority: Ceiling Protocols, Concurrent Access to Data Objects.

UNIT-IV
Implementation Aspects: Timing Services and Scheduling Mechanisms, Other Basic Operating System Functions, Processor Reserves and Resource Kernel, Open System Architecture, Capabilities of Commercial Real Time Operating Systems, Predictability of General Purpose Operating Systems.

UNIT-V
Case Studies: Vx – Works, RT Linux.

Text Books:

1. Jane W.S. Liu, “Real Time System”, Pearson Education Asia, 2001.

Suggested Reading:

1. C.M. Krishna and Kang O. Shin, “Real Time Systems”, McGraw Hill Companies Inc., 1997.
2. Raymond J.A. Buhr, Donald L. Bailey, “An Introduction to Real Time Systems”, Prentice Hall International, 1999.
3. K.V.K.K. Prasad, “Embedded Real Time Systems, Concepts, Design and Programming”, Dream Tech., 2003.

CS 356

SOFT COMPUTING
(Elective – I)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:
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:
1. Ability to apply soft computing techniques to solve different applications.
2. Design and develop various Neural Network Architectures.
3. Ability to use fuzzy logic, genetic algorithms in 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, 2008.

Suggested Readings:

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.

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CS 326

WEB TECHNOLOGIES LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. To acquire knowledge of XHTML, Java Script and XML to develop web applications
2. Ability to develop dynamic web content using Java Servlets and JSP
3. To understand JDBC connections and Java Mail API
4. To understand the design and development process of a complete web application

Course Outcomes:

1. Students will be able to develop static web sites using XHTML and Java Scripts
2. To implement XML and XSLT for web applications
3. Develop Dynamic web content using Java Servlets and JSP
4. To develop JDBC connections and implement a complete Dynamic web application

List of experiments:

1. Creation of static web site using XHTML and CSS.
2. Demonstration of XML, XSLT.
3. Validation of static web page using Java script.
4. Creation of dynamic content in web application using servlets.
5. Handling Sessions in web applications.
6. Usage of Filters in web applications.
7. Creation of dynamic content in web application using JSP
8. Providing data store support for web site using JDBC
9. Implementation of JAVA MAIL
10. CASE STUDY:

    Creation of dynamic web site using all the above topics.

Text Books :

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

CS 327

COMPILER CONSTRUCTION LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objective:

1. To implement Lexical Analyzer using Lex tool & Syntax Analyzer or parser using YACC Tool
2. To implement NFA and DFA from a given regular expression
3. To implement front end of the compiler by means of generating Intermediate codes.
4. To implement code optimization techniques.

Course Outcomes:

1. Design & implement a front end of the compiler.
2. Develop program for solving parser problems.
3. Create program for intermediate code generation and optimization of the IC.
4. Learn & use the new tools and technologies used for designing a compiler.

List of experiments:

1	Program to implement Standalone Scanner
2	Implement Scanner using LEX tool.
3	Implementing TOPDOWN PARSERS RDP
4	Implement First Method
5	Implement Follow Method
6	Program to implement LL(1) parsing technique.
7	BOTTOM UP PARSERS:Program to implement Parser using Yacc.
8	Implementing basic calculator using YACC
9	Implement Closure
10	Implement Goto
11	Intermediate code generation
12	Program to perform Code Optimization.

Text Books:

1. Keith D Cooper & Linda Tarezon, “Engineering a Compiler”, MorganKafman, Second edition.Lex&Yacc, John R Levine, Tony Mason, Doug Brown, ShroffPublishers.

Suggested Reading:

2. Kenneth C Louden, “Compiler Construction: Principles andPractice”, Cengage Learning. Lex&Yacc, John R Levine, Oreilly Publishers.

CS 328

COMPUTER NETWORKS LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. To understand various network concepts
2. Protocols and develop network related applications using those protocols. Also simulate various network protocols like ARP, Sliding Window Flow control, FTP etc. and evaluate some protocols.
3. To understanding the public key concepts

Course Outcomes:

After completion of this course, student will be able to

1. Understand about the network programming concepts
2. Develop network-oriented applications and simulate network protocols
3. Evaluate network performance
4. Implement security algorithms

Computer Networks Lab:

1. Programs using TCP sockets
2. Programs using UDP
3. Programs using Raw Sockets like packet capturing and filtering)
4. Programs using RPC
5. Simulation of Sliding Window Protocol
6. Implementation of ARP
7. Implementation and performance evaluation of routing Protocols
8. Study of UDP performance
9. Study of TCP performance
10. Implementation of RSA
11. Simulation of FTP
12. Simulation of ping

Suggested Readings:

1. UNIX Network Programming, Volume 1, W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Addison Wesley Professional, 2004
2. W. Richard Stevens, Stephen A. Rago "Advanced Programming in the UNIX Environment", Addition Wesley, 2013

CS 329

INDUSTRIAL VISIT/SUMMER INTERNSHIP

14 Periods / Semester

Students are expected to visit at least two industries during the semester and submit a detailed technical report about the industrial visit/study. The department should evaluate the reports through a committee.

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Syllabus of B.E. IV YEAR
OF
FOUR YEAR DEGREE COURSE
IN
COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (Autonomous)
Hyderabad – 500 075

WITH EFFECT FROM ACADEMIC YEAR 2016-17

Chaitanya Bharathi Institute of Technology (Autonomous)

SCHEME OF INSTRUCTION & EXAMINATION
B.E - IV Year

COMPUTER SCIENCE & ENGINEERING

SEMESTER-I

Sl.No	Syllabus Ref. No	SUBJECT	Scheme of Instructions Per Week		Scheme of Examination			Credits
			L/T	D/P	Duration in Hrs.	Maximum Marks Uni. Exam	Sessional	
		THEORY						
1	CS 411	Artificial Intelligence	4	-	3	75	25	3
2	CS 412	Distributed Computing	4	-	3	75	25	3
3	CS 413	Data Mining	4	-	3	75	25	3
4	CS 414	OOSD	4	-	3	75	25	3
5		Elective - II	4	-	3	75	25	3
		PRACTICALS						
6	CS 415	Data Mining Lab	-	3	3	50	25	2
7	CS 416	OOSD Lab	-	3	3	50	25	2
8	CS417	Project Seminar	-	3	3	-	25	1
		TOTAL	**20**	**09**	**24**	**475**	**200**	**20**

Elective-II:

CS 461 Mobile Computing
CS 463 Optimization Techniques
CS 465 Software Project Management
CS 462 Adhoc Sensor Networks
CS 464 Open Source Technologies
ME 464 Entrepreneurship

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Chaitanya Bharathi Institute of Technology (AUTONOMOUS)

SCHEME OF INSTRUCTION & EXAMINATION

B.E - IV Year
COMPUTER SCIENCE & ENGINEERING

SEMESTER-II

	Syllabus Ref. No	SUBJECT	Scheme of Instructions per Week		Scheme of Examination			Credits
					Duration in Hrs.	Maximum Marks		
			L/T	D/P		Uni. Exam	Sessionals	
THEORY								
1	CS 421	Information and Network Security	4	-	3	75	25	3
2		Elective-III	4	-	3	75	25	3
3		Elective-IV	4	-	3	75	25	3
PRACTICALS								
4	CS 422	Information and Network Security Lab	-	3	3	50	25	2
5	CS 423	Seminar	-	3	-	-	25	1
6	CS 424	Project	-	6	Viva Voce	100	50	9
		TOTAL	**12**	**12**	**12**	**275**	**175**	**21**

Elective-III:

CS 471 Data science and big data analytics
CS 472 Cloud Computing
CS 473 Semantic Web & Social Networks
CS 474 Cyber Forensics
CS 475 Human Machine Interaction
CS 476 Software Reuse Techniques

Elective-IV:

CS 481 Pattern Recognition
CS 482 Bio Informatics
CS 483 Machine Learning
CS 484 Business Intelligence
ME472 Intellectual Property Rights
CE 422 Disaster Mitigation and Management

SEMESTER-I

WITH EFFECT FROM ACADEMIC YEAR 2016-17

CS 411

ARTIFICIAL INTELLIGENCE

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To list the significance of AI.
2. To discuss the various components that are involved in solving an AI problem.
3. To analyze the various knowledge representation schemes, Reasoning and Learning techniques of AI.
4. Apply the AI concepts to build an expert system to solve the real world problems.

Course Outcomes:

After completion of the course, student should be able to:

1. Differentiate between a rudimentary Problem and an AI problem, it's Characteristics and problem solving Techniques.
2. Determine and evaluate the various search strategies.
3. Compare and contrast the various "knowledge representation" schemes of AI.
4. Understand and Analyze the various reasoning techniques involved in solving AI problems.
5. Understand the different learning techniques.
6. Apply the AI techniques to solve the real world problems.

UNIT I

Introduction & Problem Solving: AI problems, AI Technique, Defining problem as a State-Space Search, Production Systems, Problem Characteristics, Production System Characteristics.

Heuristic Search Techniques: Generate – and – test, Hill Climbing, Best – First Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis.

UNIT II

Game Playing: **O**verview, Min-Max search Procedure, Adding Alpha-beta Cutoffs, Additional Refinements, Iterative Deepening.

Knowledge Representation Issues: Approaches, Issues, Frame Problem,

Using Predicate Logic: Representing simple facts in logic, Representing Instance and ISA Relationships, Computable Functions and predicates, Resolution, Natural Deduction.

UNIT III

Uncertainty and Reasoning Techniques: Non monotonic reasoning, Logics for Non monotonic reasoning, Implementation issues, Augmenting a problem solver, implementation of Depth First Search and Breadth first search.

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Statistical reasoning: Probability and Bayes theorem, Certainty factors and Rule-based systems, Bayesian Networks, Dempster-Shafer Theory.

UNIT IV

Learning: What is Learning, Rote learning, Learning by taking advice, Learning in problem solving, learning from examples: Induction, Learning by Decision trees.

Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition.

UNIT V

Perception and Action: Real Time Search, Vision, Speech Recognition, ACTION: Navigation, Manipulation, Robot architectures.

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Statistical NLP, Spell Checking.

TEXT BOOKS:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, “Artificial Intelligence”,3rd Edition.,2008
2. Russell Norvig, “Artificial Intelligence-Modern Approach”, 3rd edition, 2009.

SUGGESTED READINGS:

1. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2012.
2. Nelson M. Mattos , “An Approach to Knowledge Base Management”, Springer Berlin Heidelberg, 1991.

CS 412

DISTRIBUTED COMPUTING

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Present the principles underlying the function of distributed computing.
2. Create an awareness of distributed computing design and implementation.
3. Describe and distinguish synchronization and concurrency control in distributed computing system.
4. Understanding distributed transaction and control of distributed deadlocks.
5. Understanding distributed computing in cloud and grid computing.

Course Outcomes:

After completion of the course, student should be able to:

1. Understand the characteristics and models in distributed computing.
2. Understand key mechanisms of remote execution.
3. Get familiar with synchronization of processes in distributed environment.
4. Acquire the knowledge of distributed transaction, concurrency and deadlock.
5. Acquire the knowledge of working of grid and cloud computing.
6. Identify the problems in developing distributed applications.

UNIT I

Characterization of Distributed Systems: Introduction, Examples of distributed systems, Resource sharing and the web, Challenges.

System Models: Introduction, Architectural models, Fundamental models.

Operating System Support: Introduction, The operating system layer, Protection, Processes and threads, Communication and invocation, Operating system architecture.

UNIT II

Interprocess communication: Introduction, The API for the internet protocols, External data representation and marshalling, Client Server communication, Group Communication.

Case study: Interprocess communication: Introduction to UNIX.

Distributed objects and Remote Invocation: Introduction, Communication between distributed objects.

Remote procedure call, Events and notifications.

Case study: Java RMI.

Name Services: Introduction, Name services and the Domain Name System.

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UNIT III
Time and Global States: Introduction, Clocks events and process states, Synchronizing physical clocks, Logical clocks, Global states, Distributed debugging.
Coordination and Agreement: distributed mutual exclusion, Election, Multicast communication, Consensus and related problems.

UNIT IV
Transactions and Concurrency Control: Introduction, Transactions, Nested transactions, Locks Optimistic concurrency control. Timestamp ordering, Comparison of methods for concurrency control.
Distributed Transactions: Introduction, Flat and nested distributed transactions, Atomic commit process, Concurrency control in distributed transactions.
Distributed deadlocks, Transaction recovery.
Replication: Introduction, System model and group communication, Fault-tolerant services.

UNIT V
Grid Computing: How Grid Computing Works, Grid Middleware, Grid Architecture, Types of Grids, Grid Computing Applications.
Service Oriented Architecture, Web Services , Service-Oriented Grid, SOA Design and Development, Advantages and the Future of SOA.
Cloud Computing: Features and Architecture, Cloud Computing Landscape.

TEXT BOOKS:

1. Colouris, Dollimore, Kindberg, " Distributed Systems concepts and Design", 5th Ed. Pearson Education, 2016.
2. Andrew S. Tanenbaum, Van Steen, " Distributed Systems" , Pearson Education , 2002.

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.

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CS 413

DATA MINING

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Understand data mining principles and techniques: Introduce DM as a cutting edge business intelligence method and acquaint the students with the DM techniques for building competitive advantage through proactive analysis, predictive modeling, and identifying new trends and behaviors.
2. Building basic terminology.
3. Learn how to gather and analyze large sets of data to gain useful business understanding.
4. Learn how to produce a quantitative analysis report/memo with the necessary information to make decisions.
5. Describing and demonstrating basic data mining algorithms, methods, and tools
6. Identifying business applications of data mining
7. Develop and apply critical thinking, problem-solving, and decision-making skills.

Course Outcomes:

After completion of the course, student should be able to:

1. Understand operational database, warehousing and multidimensional need of data base to meet industrial needs.
2. Apply the association rules for mining the data.
3. Design and deploy appropriate classification techniques.
4. Cluster the high dimensional data for better organization of the data.
5. Compare and contrast the dominant data mining algorithms.
6. Introduce knowledge gain about data mining, decision tree, neural networks and clustering.

UNIT I

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Issues in Data Mining. Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

UNIT II

Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Usage of Data Warehousing Online Analytical Processing and Mining Data Cube Computation: Efficient Methods for simple Data Cube Computation (Full Cube, Iceberg Cube, Closed Cube and Shell

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Cube), Discovery Driven exploration of data cubes, Attribute-Oriented Induction for data characterization and its implementation.

UNIT III
Mining Frequent Patterns, Associations and Correlations: Basic Concepts, The Apriori algorithm for finding frequent itemsets using candidate generation, Generating association rules from frequent itemsets, Mining frequent itemsets without candidate generation, Mining various kinds of Association Rules, Correlation Analysis.

UNIT IV
Classification and Prediction: Description and comparison of classification and prediction, preparing data for Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation Prediction, linear and non-linear regression, evaluating accuracy of a Classifier or a Predictor.

UNIT V
Cluster Analysis: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, k-means and k-mediod methods, CLARANS, Agglomerative and divisive hierarchical clustering, chameleon dynamic modeling, Constraint-Based Cluster Analysis, Outlier Analysis.

TEXT BOOKS:

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining – Concepts and Techniques" , 3rd edition, Morgan Kaufmann Publishers, ELSEVIER,2012.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2005.

SUGGESTED READINGS:

1. Sam Aanhory & Dennis Murray "Data Warehousing in the Real World" , Pearson Edn Asia.
2. K.P.Soman, S.Diwakar, V.Ajay ,"Insight into Data Mining", PHI, 2008.
3. Ralph Kimball Wiley "The Data Warehouse Life cycle Tool kit",student edition
4. William H Inmon, John Wiley & Sons Inc "Building the Data Warehouse", 2005.
5. Margaret H Dunham "Data Mining Introductory and advanced topics", Pearson education.
6. Arun K Pujari "Data Mining Techniques", 2nd edition, Universities Press.

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CS 414

OBJECT ORIENTED SYSTEM DEVELOPMENT(OOSD)

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Understanding object basics, classes and objectives, inheritance.
2. How software objects are altered to build software systems that are more robust.
3. To understand and to gain the level of competence in the area of OOSD.

Course Outcomes:

After completion of the course, student should be able to:

1. Understand the importance of modeling.
2. Understand the basic, advanced structural modeling and basic behavioral modeling.
3. Understand the advanced behavioral modeling.
4. Understand the architectural modeling.
5. Get familiar with the Unified Software Development Approach.
6. Get familiar with the concepts and various diagrams using UML.

UNIT I

UML Introduction: Necessity of a model, Introducing the UML, Hello World.
Basic Structural Modeling: Classes, Relationships, Common Mechanisms, Diagrams, Class diagrams.

UNIT II

Advanced Structural Modeling: Advanced Classes, Advanced Relationships, Interfaces, Types and Roles, Packages, Instances, Object diagrams.
Behavioral Modeling: Use Cases, Use case diagrams, Interactions, Interaction diagrams, Activity diagrams.

UNIT III

Advanced Behavioral Modeling: Events and Signals, State machines, Processes and Threads, State Chart diagrams.

UNIT IV

Architectural Modeling: Components, Component diagrams, Deployment, Deployment diagrams, Patterns and Frameworks.

UNIT V

Unified Software Development Process: The Unified Process, The Four Ps, A Use-Case Driven Process, An Architecture-Centric Process, An Iterative and Incremental Process.

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TEXT BOOKS:

1. Grady Booch, James Rumbaugh, Ivar Jacobson : The Unified Modeling Language User Guide, Pearson Education, 2007.
2. Ivar Jacobson, Grady Booch, James Rumbaugh, "The Unified Software Development Process", Rational Software Corporation,2014.

SUGGESTED READINGS:

1. Simon Bennet, Steve Mc. Robb, Ray Farmer, “Object Oriented System Analysis and Design using UML”, McGraw Hill, 2002.
2. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
3. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
4. Object-Oriented Analysis and Design with the Unified Process By John W. Satzinger, Robert B Jackson and Stephen D Burd, Cengage Learning.
5. Ali Bahrami, “Object Oriented System Development”, Tata McGraw Hill, 2015.

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CS 415

DATA MINING LAB

Instruction	3L per week
Duration of SEE	3 Hours
SEE	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. Understand basic data mining principles, to apply data mining algorithms to huge data.
2. To provide a practical exposure on data warehouse operations and schemas.
3. To be able to understand the requirements of information and knowledge gain.

Course Outcomes:

After completion of the course, student should be able to:

1. Describe the usage of data mining tools
2. Analyze the data using data mining algorithms.
3. Master on the data warehouse methods and schemas.
4. Master on the gain the knowledge using the data mining from large data.

List of programs:

1. Implement the following Multidimensional Data Models
   - i. Star Schema
   - ii. Snowflake Schema
   - iii. Fact Constellation
2. Implement Apriori algorithm to generate frequent Item Sets
3. Implement the following clustering algorithms
   - i. K-means
   - ii. K-mediods
4. Implement the following classification algorithms
   - i. Decision Tree Induction
   - ii.KNN
5. Perform Data Preprocessing using WEKA
6. Perform Discretization of data using WEKA
7. Classification algorithms using WEKA

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8. Apriori algorithm using WEKA.

9. Perform data transformations using an ETL Tool.

10. A small case study involving all stages of KDD. (Datasets are available online like UCI Repository etc.).

11. Introduction to Informatica Tool for ETL operations.

TEXT BOOK:

1. Roiger, Richard, "Data Mining : A Tutorial Based Primer".

SUGGESTED READINGS:

1. K.P.Somen, Shyam Diwakar and V.Aja,"Insight into Data Mining theory and practice", Eastern Economy Edition, Prentice Hall of India, 2006.

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CS 416

OOSD LAB

Instruction	3L per week
Duration of SEE	3 Hours
SEE	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. Develop a problem statement.
2. Develop an standard SRS document.
3. Design various UML diagrams.

Course Outcomes:

After completion of the course, student should be able to:

1. Identity the conceptual classes and develop a domain model with UML Class diagram.
2. Identify Use Cases and develop the Use Case model.
3. Usethe identified scenarios find the interaction between objects and represent those using UML Interaction diagrams.
4. Identify the business activities and develop an UML Activity diagram.
5. Draw the State Chart diagram.
6. Draw Component and Deployment diagrams.

List of Programs:

Select one Information System/Approach and device the following using UML tool:

1. Structured Diagrams (Data Flow Diagrams, Entity-Relationship Diagrams etc..)
2. Preparation of Software Requirement Specification Document for a given Case Study.

UML Diagrams

1. Use Case Diagrams
2. Class Diagrams
3. Object Diagrams
4. Sequence Diagrams
5. Collaboration Diagrams
6. Activity Diagrams
7. State Chart Diagrams
8. Component Diagrams
9. Deployment Diagrams

TEXT BOOKS:

1. Simon Bennet, Steve Mc. Robb, Ray Farmer, “Object Oriented System Analysis and Design using UML”, McGraw Hill, 2002.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.

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CS 417

PROJECT SEMINAR

Instruction	3L per week
Sessionals	25 Marks
Credits	1

Dealing with a real time problem should be the focus of under graduate project.

Faculty members should prepare project briefs (giving scope and references) well in advance, which should be made available to the students in the department.
The project may be classified as hardware / software modeling / simulation. It may comprise any or all elements such as analysis, design and synthesis.

The department should appoint a project coordinator who will coordinate the following.

- Grouping of students (a maximum of 3 in group)
- Allotment of projects and project guides
- Project monitoring at regular intervals.

All project allotment are to be completed by the 3rd week of IV–Year, I-Semester, so that the students get sufficient time for completion of the project by the end of II-semester.

Efforts be made the some of the projects are carried out in reputed industries / research organizations with the help of industry coordinators. Problems can also be invited from the industries to be worked out through undergraduate projects.

Oral presentation is an important aspect of engineering education. The students have to deliver a seminar on the 'project' they have chosen or allotted by the department, on the advice and approval from the faculty members. Students are exposed to the following aspects for seminar presentation.

- Literature Survey
- Organization of the material
- Power point presentation
- Technical writing

Each student project batch is required to:

1. Submit a one-page synopsis before the seminar talk for display on the notice board.
2. Give a 20-30 minutes presentation through power point presentation.
3. Submit a report on the project with list of references and slides used.

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Project Seminars are to be scheduled from the 4th week of the I-semester to the last week of the I-semester.

For award of Sessional marks students are judged by the project coordinator and guide on the basis of an oral and written presentation as well as their involvement in the discussions.

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Elective II:

CS 461

MOBILE COMPUTING

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Understand and identify the GSM, GPRS and Bluetooth software model for mobile computing.
2. Understand, analyze and explain problems associated to localization and movements, the wireless and wired communication architecture, handling of data and business application over slow wireless networks.
3. Understand and identify business data management and security issues over slow wireless media.
4. Understand, analyze and explain working of software mobile agents over long distances, transaction processing over wire and wireless media.
5. Introduce with ad-hoc networks, clustering and their usage in practical world.
6. Understand various routing and communication protocols and QoS over wire and wireless channels.
7. Understand and recognize CDMA and other network applications.

Course Outcomes:

After completion of the course, student should be able to:

1. Understand working, characteristics and limitations of mobile hardware devices including their user-interface modalities.
2. Understand and learn frequency band, spectrum, air interface and channel structure.
3. Understand the necessary knowledge of cellular communication, infrastructure-less networks.
4. Analyze TCP, MAC protocols and their technical feasibility.
5. Work as a part of team on multidisciplinary and device independent application projects.
6. Understand and implement the hardware components/architectures/databases/operating system of mobile networks that is necessary to built self confidence to develop novel products and solutions for real world.

UNIT I

Introduction: History of wireless communication, Applications, Wireless transmission. Frequencies for radio transmission, Regulations, Signals, Antennas, Signal propagation, Multiplexing, Spread spectrum, Cellular Systems.

UNIT II

Medium access control : motivation for a specialized MAC, SDMA, FDMA, TDMA, CDMA . Telecommunication Systems : GSM, GPRS, DECT.

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Satellite Networks – Applications, Basics, Routing, Localization, Handover, Examples.

UNIT III

Broadcast Systems: DAB , DVB.

Wireless LAN :IEEE 802.11 , Architecture ,services ,MAC ,Physical layer.

IEEE 802.11 a , 802.11 b standards ,HIPERLAN , Bluetooth.

UNIT IV

Mobile IP, Dynamic Host Configuration Protocol, Routing in MANETs – Routing, DSDV, DSR, Alternative metrics, Overview ad-hoc routing protocols.

UNIT V

Traditional TCP – Classical TCP improvements – WAP, and WAP 2.0., File Systems and Mobility Management, Windows CE, Palm OS, Symbian OS.

TEXT BOOKS:

1. Jochen H. Schiller, "Mobile Communications", Addison Wesley, Second Edition, 2003.
2. William Stallings, "Wireless Communications and Networks", PHI/Pearson Education, 2002.

SUGGESTED READINGS:

1. Asoke K Talukder, et al, "Mobile Computing", Tata McGraw Hill, 2008.
2. Raj Kamal, "Mobile Computing", Oxford University press.

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CS 462

ADHOC SENSOR NETWORKS

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To impart knowledge of adhoc networks, design and implementation issues, and available solutions.
2. To impart knowledge of routing mechanisms and the three classes of approaches: proactive, on-demand, and hybrid.
3. To provide knowledge of sensor networks and their characteristics.
4. Study the Applications of Sensor Networks.

Course Outcomes:

After completion of the course, student should be able to:

1. Describe the unique issues in ad-hoc/sensor networks.
2. Understand current technology trends for the implementation and deployment of wireless ad-hoc/sensor networks.
3. Explain the challenges in designing MAC, routing and transport protocols for wireless ad-hoc sensor networks.
4. Gain knowledge on implementation of protocols on a sensor test bed network.
5. Explain the principles of mobile ad hoc networks (MANETs)
6. Explain the principles and characteristics of wireless sensor networks (WSNs).

UNIT I

Introduction to Ad-Hoc networks, Wireless LANs, Wireless PANs, Wireless Mesh Networks, Topology Control in Wireless Ad Hoc Networks, Broadcasting and Activity Scheduling in Ad Hoc Networks, Location Discovery, Mobile Ad Hoc Networks (MANETs): Routing Technology for Dynamic Wireless Networking, Congestion Control in ad hoc wireless networks.

UNIT II

Introduction, Routing in Ad Hoc Networks, Broadcasting, Multicasting and Geocasting, Mobile Ad-Hoc Networking with a View of 4G Wireless: Imperatives and Challenges, Off-the-Shelf Enables of Ad Hoc Networks, IEEE 802.11 in Ad Hoc Networks: Protocols, Performance and Open Issues.

UNIT III

Media Access Control (MAC) Protocols: Issues in designing MAC protocols, Classifications of MAC protocols, MAC protocols, Cognitive Radio and Networks, TCP over Ad Hoc Networks, Energy-Efficient Communication in Ad Hoc Wireless Networks, Ad Hoc Networks Security, Self-Organized and Cooperative Ad Hoc Networking, Security in Ad Hoc and Sensor Networks.

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UNIT IV

Introduction to Sensor networks, Introduction and Overview of Wireless Sensor Networks: Applications of Wireless Sensor Networks, Examples of Category 1 WSN Applications, Basic Wireless Sensor Technology: Sensor Node Technology, Sensor Taxonomy, WSN Operating Environment, WSN Trends.

UNIT V

Sensor Networks Design Considerations, Sensor Networks in Controlled Environment, Wireless Transmission Technology and Systems: Radio Technology Primer, Available Wireless Technologies. Medium Access Control Protocols for Wireless Sensor Networks: Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC Case Study, IEEE 802.15.4 LR-WPANs Standard Case Study.

Integrating MANETs, WLANs and Cellular Networks, Networking Sensors: Unique features, Deployment of ad-hoc/sensor network, Sensor tasking and control, Transport layer and security protocols, Applications of Sensor Networks.

TEXT BOOKS:

1. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, “Ad Hoc and Sensor Networks : Theory and Applications”, Second Edition, World Scientific Publishers, 2011
2. Prasant Mohapatra and Sriramamurty, “Ad Hoc Networks: Technologies and Protocols”, Springer International Edition, 2009
3. Kazem Sohraby, Daniel Minoli, Taieb Znati, “Wireless Sensor Networks’, A John Wiley & Sons Inc. Publication, 2007

SUGGESTED READINGS:

1. C. Siva Ram Murthy & B. S. Manoj, “Ad hoc Wireless, Networks – Architecture and Protocols”, Prentice Hall, 2004.
2. Jagannathan Sarangapani, Wireless Ad hoc and Sensor Networks: Protocols, Performance, and Control, CRC Press, 2007.

CS 463

OPTIMIZATION TECHNIQUES

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.
2. To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology
3. To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems**.**

Course Outcomes:

After completion of the course, student should be able to:

1. Get awareness about the real world problems, their understanding and ability to formulate mathematical models of these problems.
2. Understand the Transportation model, Traveling salesman and ability to find optimal solution.
3. Understand the major limitations and capabilities of deterministic operations research modeling as applied to problems in industry or government.
4. Learn to handle, solve and analyze problems using linear programming and other mathematical programming algorithms.
5. Learn how to deal with real world problems of Network analysis, Project Management, for their optimal solutions; for example, they understand how much optimum cable wire is required to give cable connection to some buildings connected by a network.
6. Learn different techniques to solve Non- Linear Programming Problems.

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 L.P.P. 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. Travelling Salesman problem and assignment problem.
Sequencing models, solution of sequence 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 AII 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 2Xn or mX2 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. Kantiswarup,Gupta P.K.& Sultan Chand & Sons Manmohan, "Operations Research" 9th Edition, ,2013.
2. Taha H.A.,"Operations Research-An Introduction" 6th Edition, Hall of India, 2014.

SUGGESTED READINGS:

1. R. Panneerselvam **, "**Operations research**",** PHI Learning Pvt. Ltd.,2006.

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CS 464

OPEN SOURCE TECHNOLOGIES

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course objectives:

1. Understand the difference between open source software and commercial software.
2. Familiarity with Linux operating system.
3. Understanding and development of web applications using open source web technologies like Apache, MySql and PHP (LAMP/XAMP).

Course Outcomes:

After completion of the course, student should be able to:

1. Understand the difference between open source software and commercial software.
2. Identify, install and run Linux operating system.
3. Install and manage applications.
4. Identify, install open source web technologies Apache, MySql, PHP.
5. Develop web applications using LAMP.
6. Write session control PHP code for a website.

UNIT I

OPEN SOURCE: Introduction to Open Source – Open Source vs. Commercial Software – What is Linux? - Free Software – Where I can use Linux? Linux Kernel – Linux Distributions

UNIT II

LINUX: Introduction to Linux Essential Commands - Filesystem Concept - Standard Files

1. The Linux Security Model - Vi Editor - Partitions creation - Shell Introduction
2. String Processing - Investigating and Managing Processes - Network Clients - Installing Application

UNIT III

APACHE: Apache Explained - Starting, Stopping, and Restarting Apache - Modifying the Default Configuration - Securing Apache - Set User and Group - Consider Allowing Access to Local Documentation - Don't Allow public html Web sites - Apache control with .htaccess

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UNIT IV

MYSQL: Introduction to MYSQL - The Show Databases and Table - The USE command - Create Database and Tables - Describe Table - Select, Insert, Update, and Delete statement - Some Administrative detail - Table Joins - Loading and Dumping a Database.

UNIT V

PHP: Introduction- General Syntactic Characteristics - PHP Scripting - Commenting your code - Primitives, Operations and Expressions - PHP Variables - Operations and Expressions Control Statement - Array - Functions - Basic Form Processing - File and Folder Access - Cookies - Sessions - Database Access with PHP - MySQL - MySQL Functions - Inserting Records - Selecting Records - Deleting Records - Update Records.

TEXT BOOK:

1. James Lee and Brent Ware ,"Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP", , Dorling Kindersley(India) Pvt. Ltd, 2008.

SUGGESTED READINGS:

1. Eric Rosebrock, Eric Filson ,"Setting Up LAMP: Getting Linux, Apache, MySQL, and PHP and working Together", Published by John Wiley and Sons, 2004.

CS 465

SOFTWARE PROJECT MANAGEMENT

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Understand the fundamental principles of Software Project management & will also have a good knowledge of responsibilities of project manager and how to handle these.
2. Be familiar with the different methods and techniques used for project management.
3. To have good knowledge of the issues and challenges faced while doing the Software project Management.
4. Will be able to understand why majority of the software projects fails and how that failure probability can be reduced effectively.
5. Will be able to do the Project Scheduling, tracking, Risk analysis, Quality management and Project Cost estimation using different techniques.

Course Outcomes:

After completion of the course, student should be able to:

1. Understand and practice the process of project management and its application in delivering successful IT projects.
2. Evaluate a project to develop the scope of work, provide accurate cost estimates and to plan the various activities.
3. Understand and use risk management analysis techniques that identify the factors that put a project at risk and to quantify the likely effect of risk on project timescales.
4. Identify the resources required for a project and to produce a work plan and resource schedule.
5. Monitor the progress of a project and to assess the risk of slippage, revising targets or counteract drift.
6. Distinguish between the different types of project and follow the stages needed to negotiate an appropriate contract.

UNIT I

Conventional Software Management: The Waterfall Model, Conventional software Management Performance.

Evolution of Software Economics: Software Economics, Pragmatic Software Cost Estimation.

Improving Software Economics: Reducing Software Product Size, improving software processes, improving team effectiveness, Improving Automation through Software Environments, Achieving Required Quality.
Old way and the new: The Principles of Conventional Software Engineering and Moden Software Management.

UNIT II
Life cycle phases: Engineering and Production Stages,Inception Phase, Elaboration Phase,Construction Phase, Transition Phase.
Artifacts of the process: The Artifact Sets, Management Artifacts, Engineering Artifacts, Pragmatic Artifacts.
Model based software architectures: Management Perspective,Technical Perspective.
Work Flows of the process, Checkpoints of the process.

UNIT III
Iterative Process Planning, Project Organizations and Responsibilities, Process Automation, Project Control of Process instrumentation, tailoring the Process.

UNIT IV
Modern Project Profiles, Next generation Software economics, modern process transitions, Managing Contracts, Managing People and Organizing Teams.

UNIT V
Process Improvement and Managing to the CMM, ISO 12207- an Overview, Program Management. A Case Study.

TEXT BOOK:

1. Walker Royce ,"Software Project Management" , Pearson Education, 2005.
2. Bob Hughes and Mike Cotterell ,"Software Project Management", Tata McGraw-Hill Edition-2011.

SUGGESTED READINGS:

1. Joel Henry "Software Project Management" , Pearson Education, First Edition, 2004.
2. Pankaj Jalote "Software Project Management in practice" , Pearson Education,2005.

SEMESTER-II

WITH EFFECT FROM THE ACADEMIC YEAR 2016 - 2017

CS 421

INFORMATION AND NETWORK SECURITY

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Deal with the underlying principles of information and network security.
2. Deal with the construction and cryptanalysis of block ciphers, stream ciphers and hash functions.
3. Define one way functions and trap-door functions and presents the construction and cryptanalysis of public key ciphers, namely RSA.
4. Deal with the key exchange problem and solutions using the Diffie-Hellman and Message Authentication Codes (MAC) and signature schemes.

Course Outcomes:

After completion of the course, student should be able to:

1. Understand the most common type of information and network threat sources.
2. Understand the Public-Key Infrastructure.
3. Understand security protocols for protecting data on networks.
4. Understand the information and network security issues and apply the related concepts for protection and communication privacy.
5. Understand application security using smart- cards.
6. Understand the operation of e-payments, micro- payments and related security issues, protocols.

UNIT 1

Planning for Security: Introduction, Information Security Policy, Standards, and Practices; The Information Security Blue Print; Contingency plan and a model for contingency plan
Security Technology: Introduction; Physical design; Firewalls; Protecting Remote Connections
Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools.

UNIT II

Cryptography: Introduction; A short History of Cryptography; Principles of Cryptography; Cryptography Tools; Attacks on Cryptosystems.

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UNIT III

Introduction to Network Security, Authentication Applications: Attacks, services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security; Internet Standards and RFCs Kerberos, X.509 Directory Authentication Service.

UNIT IV

Electronic Mail Security: Pretty Good Privacy (PGP); S/MIME

IP Security: IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management.

UNIT V

Web Security: Web security requirements; Secure Socket layer (SSL) and Transport layer Security (TLS); Secure Electronic Transaction (SET).

TEXT BOOKS:

1. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 2nd Edition, Cengage Learning, 2005.

2. William Stallings: Network Security Essentials: Applications and Standards, 3rd Edition, Pearson Education, 2007.

SUGGESTED READINGS:

1. Behrouz A. Forouzan "Cryptography and its principles".

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CS 422

INFORMATION AND NETWORK SECURITY LAB

Instruction	3 per week
Duration of SEE	3 Hours
SEE	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. Understand basic cryptography principles, including some well known algorithms for symmetric and public key encryption, digital signatures, key management.
2. To provide a practical exposure of both the principles and practice of advanced cryptography.
3. Understand and fulfill the requirements C.I.A .
4. Understand the underlying principles of information and network security.

Course Outcomes:

After completion of the course, student should be able to:

1. Demonstrate detailed knowledge of the role of encryption to protect data.
2. Analyze security issues arising from the use of certain types of technologies.
3. Master protocols for security services.
4. Master on the key exchange and Authentication protocols.

List of Programs:

3. Java program to perform encryption and decryption using the following algorithms
   a. Ceaser cipher b. Substitution cipher c. Hill Cipher
4. C program to implement the DES algorithm logic.
5. JAVA program to implement the DES algorithm logic.
6. JAVA program that contains functions, which accept a key and input text to be encrypted/decrypted. This program should use the key to encrypt/decrypt the input by using the triple DES algorithm. Make use of Java Cryptography package.
7. C/JAVA program to implement the Blowfish algorithm logic
8. Java program to implement RSA algorithm.
9. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
10. Calculate the message digest of a text using the MD5 algorithm in JAVA.
11. Explore the Java classes related to digital certificates.
12. Create a digital certificate of your own by using the Java key tool

TEXT BOOKS:

1. Michael Gregg "Build Your Own Security Lab" , Wiley India.

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SUGGESTED READINGS:

1. Alfred Basta, Wolf Halton, "Computer Security, concepts, issues and implementation:, Cengage Learning".

Professor and Head Department

CS 423

SEMINAR

Instruction	3L per week
Sessional	25 Marks
Credits	1

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of the specialization.

Seminar topics may be chosen by the student with advice and approval from the faculty members. Students are to be exposed to the following aspects of seminar presentation.

- Literature Survey
- Consolidation of available information
- Power point presentation
- Technical writing

Each student is required to:

1. Submit a one-page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through power point followed by a 10 minutes discussion.
3. Submit a report on the seminar topic with list of references.

Seminars are to be scheduled from the 3rd week of to the last week of the II-semester.

For award of Sessional marks students are judged on the basis of an oral and written presentation as well as their involvement in the discussions by at least two faculty members.

Professor and Head Department

CS 424

PROJECT

Instruction	6L per week
University Examination	Viva-voce
University Examination	100 Marks
Sessional	50 Marks
Credits	9

Dealing with a real time problem should be the focus of under graduate project.

All projects will be monitored at least four times in the II-semester through individual presentations (Project batch wise).

Every student should maintain a project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Problems can also be invited from the industries to be worked out through undergraduate projects. Efforts may be made such that the projects may be carried out in reputed industries/ research organizations/PSUs.

Sessional marks should be based on the marks, awarded by a monitoring project committee of faculty members as well as the marks given by the guide.

Common norms should be established for final documentation of the project report by the respective department on the following lines:

1. The project title should be task oriented for example “Design and Analysis of ……….”
2. Objectives of the project should be identified clearly and each student of the project batch should fulfill at least one of the objectives identified. The chapters of the project report should reflect the objectives achieved.

3. Contents of the report should include the following
   a. Title page
   b. Certificate
   c. Acknowledgements
   d. Abstract (limited to one/two paragraphs, page no.1 should start from this)
   e. Contents (Ch. No. Title of the chapter/section Page No.)
   f. List figures (Fig. No. caption of the figure Page No.)
   g. List of Tables (Table. No. Caption of the table Page No.)
   h. List of Symbols (ex. C: Velocity of light 3×10^8 m/s)

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i. Chapter I should be introduction . This should contain sections as objectives of the project, technical approach, literature survey, the importance of the project and organization of the report.

j. The remaining chapters should include regarding the implementation of the project, results with discussions and conclusions. Students are expected to write about future scope of the project.

k. References should be indicated as per IEEE or standard format, which should be duly referred in the report.

l. The algorithms related to the software developed should be thoroughly discussed in Appendices

etc..

4. The project reports should be hard bound.

The project report should be evaluated for 100 Marks by the External Examiner.

The project work, if found inadequate in the external examination, the candidate should repeat the project work with a new problem or improve the quality of work and report it again.

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Elective - III

WITH EFFECT FROM THE ACADEMIC YEAR 2016 - 2017

CS 471

DATA SCIENCE AND BIG DATA ANALYTICS

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Applying and understanding the big data flow for the actual projects.
2. Understands the lifecycle of the data analytics & big data ecosystem and able to apply for real world problems.
3. Acquires knowledge on the tools and techniques for solving big data analytics.
4. Learns how to apply the mining techniques on big data.

Course Outcomes:

After completion of the course, student should be able to:

1. Have a clear idea about the big data flow and its ecosystem.
2. Apply the tools and techniques on big data while applying data mining techniques.
3. Use statistical tool and statistical methods that can be applied on big data.
4. Have a clear idea about how to represent the unstructured data in the data bases.
5. Understand the common Hadoop ecosystem components, Hadoop Architecture, HDFS, Anatomy of File Write and Read, Rack Awareness.
6. Understand Hadoop Map Reduce framework and the working of MapReduce on data stored in HDFS.

UNIT 1

Introduction to Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics.

Data Analytics Lifecycle: Data Analytics Lifecycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize, Case Study: Global Innovation Network and Analysis (GINA).

Review of Basic Data Analytic Methods Using R: Introduction to R, Exploratory Data Analysis, Statistical Methods for Evaluation.

UNIT II

Advanced Analytical Theory and Methods- Clustering: Overview of Clustering, K-means, Additional Algorithms.

Advanced Analytical Theory and Methods-Association Rules: Overview, Apriori Algorithm, Evaluation of Candidate Rules , Applications of Association Rules, An Example: Transactions in a Grocery Store , Validation and Testing , Diagnostics.

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UNIT III

Advanced Analytical Theory and Methods- Regression : Linear Regression, Logistic Regression, Reasons to Choose and Cautions, Additional Regression Models.

Advanced Analytical Theory and Methods-Classification: Decision Trees , Naïve Bayes , Diagnostics of Classifiers, Additional Classification Methods.

UNIT IV

Advanced Analytical Theory and Methods-Time Series Analysis: Overview of Time Series Analysis, ARIMA Model, Additional Methods.

Advanced Analytical Theory and Methods-Text Analysis: Text Analysis Steps, A Text Analysis Example, Collecting Raw Text , Representing Text, Term Frequency--Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insights.

UNIT V

Advanced Analytics--Technology and Tools-MapReduce and Hadoop: Analytics for Unstructured Data, The Hadoop Ecosystem, NoSQL.

Advanced Analytics--Technology and Tools-In-Database Analytics: SQL Essentials, In-Database Text Analysis, Advanced SQL.

The Endgame or Putting It All Together: Communicating and Operationalizing an Analytics Project, Creating the Final Deliverables, Data Visualization Basics.

TEXT BOOKS:

1. EMC Education Services “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data” Wiley Publishers
2. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
3. Tom White “ Hadoop: The Definitive Guide” Third Edition, O‟reilly Media, 2011.
4. Prajapati, "V. Big data analytics with R and Hadoop", Packt Publishing Ltd, 2013.

SUGGESTED READINGS:

1. Frank J. Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley Publishers.
2. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.
3. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
4. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007 5. Pete Warden, “Big Data Glossary”, O’Reilly, 2011.

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CS 472

CLOUD COMPUTING

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

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 secutrity 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:
After completion of the course, student should 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 and explore virtualization techniques that serve in offering software, computation and storage services on the cloud.
3. Apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost.
4. Illustrate the concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and HDFS.
5. Understand the security and privacy issues related to cloud computing environments.
6. Analyze various cloud programming models and apply them to solve problems on the cloud.

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.

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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 READINGS:

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.
4. Web resources:

a. http://aws.amazon.com
b. http://code.google.com/appsengine
c. http://www.buyya.com/

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CS 473

SEMANTIC WEB AND SOCIAL NETWORKS

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To learn Web Intelligence.
2. To explain Knowledge Representation for the Semantic Web.
3. To learn Ontology Engineering.
4. To learn Semantic Web Applications, Services and Technology.
5. To learn Social Network Analysis and semantic web.

Course Outcomes:

After completion of the course, student should be able to:

1. Understand the evolution of the web and the need of the semantic web
2. Understand the semantic web technologies such as RDF, OWL to represent knowledge
3. Understand and analyze the ontology and apply for the application with appropriate methods and tools.
4. Understand the need and applications of social network analysis and the scope of these applications in the web.
5. Analyze and explain how technical changes affect the social aspects of web based computing.
6. Create an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods.

UNIT I

Web Intelligence

Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

UNIT II

Knowledge Representation for the Semantic Web

Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web – Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.

UNIT III

Ontology Engineering:

Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

UNIT IV

Semantic Web Applications, Services and Technology:

Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods,

UNIT V

Social Network Analysis and semantic web:

What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

TEXT BOOKS:

1. Berners Lee, Godel and Turing, "Thinking on the Web ", Wiley inter science, 2008.
2. Peter Mika ,"Social Networks and the Semantic Web" , Springer, 2007.

SUGGESTED READINGS:

1. J.Davies, R.Studer, P.Warren ,"Semantic Web Technologies, Trends and Research in Ontology Based Systems" , John Wiley & Sons, 2006.
2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
3. Heiner Stuckenschmidt; Frank Van Harmelen "Information Sharing on the semantic Web" , Springer Publications, 2005.
4. T.Segaran, C.Evans, J.Taylor, O'Reilly "Programming the Semantic Web" , SPD,2009.

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CS 474

CYBER FORENSICS

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Identify and present indicators that a cybersecurity incident has occurred.
2. Apply criminal justice methods to cybersecurity and computer forensic investigations.
3. Plan, implement, and evaluate penetration testing and ethical hacking of computer systems.
4. Identify, analyze, and mitigate threats to internal computer systems.
5. Collect, process, analyze, and present computer forensic evidence.

Course Outcomes:

After completion of the course, student should be able to:

1. Help the organization to continue its commercial activities in the event of significant information security incidents.
2. Be proficient in various forensic tools and usage of tools for disk imaging and recovery processes.
3. Design security procedures and policies.
4. Well versed in various security standards and security testing techniques.
5. Work in teams to analyze and resolve cyber security issues.
6. Apply critical thinking skills to risk analysis of computer systems.

UNIT 1

Introduction: Introduction of Cybercrime: Types, The Internet spawns crime, Worms versus viruses, Computers' roles in crimes, Introduction to digital forensics, Introduction to Incident - Incident Response Methodology – Steps - Activities in Initial Response, Phase after detection of an incident.

UNIT II

Initial Response and forensic duplication: Initial Response & Volatile Data Collection from Windows system - Initial Response & Volatile Data Collection from Unix system – Forensic Duplication: Forensic duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic.
Duplicate/Qualified Forensic Duplicate of a Hard Drive.

UNIT III

Preserving and Recovering Digital Evidence: File Systems: FAT, NTFS - Forensic Analysis of File Systems – Storage Fundamentals: Storage Layer, Hard Drives Evidence Handling: Types of Evidence, Challenges in evidence handling, Overview of evidence handling procedure.

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UNIT IV

Network Forensics and System investigation: Intrusion detection; Different Attacks in network, analysis Collecting Network Based Evidence - Investigating Routers - Network Protocols - Email Tracing- Internet Fraud.

Data Analysis Techniques - Investigating Live Systems (Windows & Unix) Investigating.

Hacker Tools - Ethical Issues – Cybercrime.

UNIT V

Bodies of law: Constitutional law, Criminal law, Civil law, Administrative regulations, Levels of law: Local laws, State laws, Federal laws, International laws , Levels of culpability: Intent, Knowledge, Recklessness, Negligence Level and burden of proof : Criminal versus civil cases ,Vicarious liability, Laws related to computers: CFAA, DMCA, CAN Spam, etc. Right to Information Act.

TEXT BOOKS:

1. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, Tata McGrawHill, 2006.
2. Peter Stephenson, "Investigating Computer Crime: A Handbook for Corporate Investigations", Sept 1999.
3. Eoghan Casey, "Handbook Computer Crime Investigation's Forensic Tools and Technology", Academic Press, 1st Edition, 2001.

SUGGESTED READINGS:

1. Skoudis. E., Perlman. R. Counter Hack: A Step-by-Step Guide to Computer Attacks and Effective Defenses.Prentice Hall Professional Technical Reference. 2001.
2. Norbert Zaenglein, "Disk Detective: Secret You Must Know to Recover Information From a Computer", Paladin Press, 2000.
3. Bill Nelson, Amelia Philips and Christopher Steuart, “Guide to computer forensics investigation “Course technology, 4th edition.

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CS 475

HUMAN MACHINE INTERACTION

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Design, evaluate and deploy usable, effective technologies
2. Produce a low-fidelity prototype for an interactive product based upon a simple list of interaction design principles.
3. To understand the importance of human Psychology in designing good interfaces.

Course Outcomes:

After completion of the course, student should be able to:

1. Think constructively & analytically about how to design and evaluate interactive technologies.
2. Determine the most appropriate HCI methods to meet the needs of a practical software development project.
3. Design effective interactive systems that are usable due to adherence to established guidelines.
4. Select and apply the appropriate design methodology.
5. Demonstrate understanding of Interaction between the human and computer components.
6. Design innovative, user centric and user friendly interfaces.

UNIT I

Interaction Paradigms: Computing Environments, Analyzing Interaction Paradigms.
Interaction Frameworks and Styles: Frameworks for Understanding Interaction, Coping with Complexity, Interaction Styles.

UNIT II

Interaction Design Process: Iterative Design, User-Centered Design, Interaction Design Models, Overview of Interaction Design Models.
Discovery: Discovery Phase Framework, Collection, Interpretation , Documentation.
Design: Conceptual Design, Physical Design, Evaluation, Interface Design Standards, Designing the Facets of the Interface.

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UNIT III

Design Principles: Principles of Interaction Design, Comprehensibility, Learnability, Effectiveness/Usefulness, Efficiency/Usability, Grouping, Stimulus Intensity , Proportion , Screen Complexity, Resolution/Closure, Usability Goals.

Interaction Design Models: Model Human Processor , Keyboard Level Model, GOMS, Modeling Structure, Modeling Dynamics, Physical Models.

Usability Testing: Usability, Usability Test, Design the Test, Prepare for the Test, Perform the Test, Process the Data.

UNIT IV

Interface Components: The WIMP Interface, Other Components.

Icons : Human Issues Concerning Icons, Using Icons in Interaction Design, Technical Issues Concerning Icons.

Color: The Human Perceptual System, Using Color in Interaction Design, Color Concerns for Interaction Design, Technical Issues Concerning Color.

UNIT V

Text : Human Issues Concerning Text, Using Text in Interaction Design, Technical Issues Concerning Text.

Speech and Hearing : The Human Perceptual System, Using Sound in Interaction Design, Technical Issues Concerning Sound.

Touch and Movement: The Human Perceptual System, Using Haptics in Interaction Design, Technical Issues Concerning Haptics.

TEXT BOOKS:

1. Steven Heim, "The Resonant Interface: HCI Foundations for Interaction Design", Addison-Wesley, 2007.
2. J. Preece, Y. Rogers, and H. Sharp, Interaction Design: "Beyond Human-Computer Interaction", Wiley & Sons, 2nd Ed., 2007.

SUGGESTED READINGS:

1. Ben Shneiderman , Catherine Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 5th edition, , Addison-Wesley, 2009.
2. Alan Dix, “Human-computer Interaction” Pearson/Prentice-Hall, 2004.

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CS 476

SOFTWARE REUSE TECHNIQUES

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To explain the benefits of software reuse.
2. To discuss several different ways to implement software reuse.
3. To explain how reusable concepts can be represented as patterns.
4. To comprehend the nature of design patterns.
5. To provide a specific context for each pattern in which it is applied.

Course Outcomes:

After completion of the course, student should be able to:

1. Identify and describe the different approaches and techniques to the software reuse development.
2. Determine and apply the knowledge acquired on software reuse techniques.
3. Apply the design patterns in creating an object oriented design.
4. Use design patterns for real world situations.
5. List consequences of applying each pattern.

UNIT I

Software reuse success factors: Reuse driven software engineering as business, object oriented software engineering, Applications and Component subsystems, Use case components, Object components.

UNIT II

Design Patterns : Introduction, Creational Patterns – Factory, factory method, abstract factory, singleton, builder, prototype.

UNIT III

Structural Patterns : Adapter, bridge, composite, decorator, façade, flyweight, proxy. Behavioral Patterns : Chain of responsibility, command, interpreter.

UNIT IV

Behavioral Patterns : Iterator, mediator, memento, observer, state, strategy, template, visitor. Other design patterns : Whole – part, master – slave, view handler, forwarder – receiver, client dispatcher – server, publisher – subscriber.

UNIT V

Architectural Patterns – Layers, pipes and filters, black board, broker, model-view controller, presentation – abstraction – control, micro kernel, reflection.

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TEXT BOOKS:

1. Ivar Jacabson, Martin Griss, Patrick Johnson, "Software Reuse: Architecture, Process and Organization for Business Success", ACM Press 1997.
2. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides – " Design Patterns", Pearson Education, 1995.

SUGGESTED READINGS:

1. Frank Buschmann etc., - "Pattern Oriented Software Architecture – Volume I", Wiley 1996.
2. James W Cooper, "Java Design Patterns, a tutorial", Pearson Education, 2000.

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Elective – IV

WITH EFFECT FROM THE ACADEMIC YEAR 2016 - 2017

CS 481

PATTERN RECOGNITION

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To introduce the students about fundamentals of image formation.
2. To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition.
3. To develop an appreciation for various issues in the design of computer vision and object recognition systems.
4. To provide the students with computer vision and object recognition applications.

Course Outcomes:

After completion of the course, student should be able to:

1. Understand the fundamentals of image formation.
2. Comprehend the major ideas, methods and techniques of image processing and computer vision.
3. Understand typical pattern recognition techniques for object recognition.
4. Implement the basic image processing and computer vision techniques.
5. Develop simple object recognition systems.
6. Implement simple pattern classifier, classifier combination and structural pattern recognizers.

Unit I

Classifiers Based on Bayes Decision Theory: Introduction , Bayes Decision Theory, Discriminant Functions and Decision Surfaces , Bayesian Classification for Normal Distributions.

Estimation of Unknown Probability Density Functions: Maximum Likelihood Parameter Estimation , Maximum a Posteriori Probability Estimation, Bayesian Inference , Maximum Entropy Estimation , Mixture Models , Nonparametric Estimation ,The Naive-Bayes Classifier , The Nearest Neighbor Rule, Bayesian Networks.

Unit II

Linear Classifiers: Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm , Least Square Methods.

Mean Square Estimation Revisited: Logistic Discrimination, Support Vector Machines.

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Unit III

Non Linear Classifiers: The XOR Problem , The Two-Layer Perceptron , Three Layer Perceptrons.

Algorithms Based on Exact Classification of the Training Set: The Backpropagation Algorithm , Variations on the Backpropagation Theme, The Cost Function Choice, Choice of the Network Size, A Simulation Example , Networks with Weight Sharing, Generalized Linear Classifiers, Capacity of the *l*-Dimensional Space in Linear Dichotomies, Polynomial Classifiers, Radial Basis Function Networks, Universal Approximators.

Support Vector Machines: The nonlinear Case, Decision Trees, Combining Classifiers , The Boosting Approach to Combine Classifiers.

Unit IV

Feature Selection: Preprocessing, Feature Selection Based on Statistical Hypothesis Testing, The Receiver Operating Characteristics (ROC) Curve , Class Separability Measures , Feature Subset Selection , Optimal Feature Generation , Neural Networks and Feature Generation / Selection, The Bayesian Information Criterion.

Feature Generation: Linear Transforms, Regional Features, Features for Shape and Size Characterization, Typical Features for Speech and Audio Classification.

Unit V

Template Matching: Introduction, Similarity Measures Based on Optimal Path Searching Techniques, Measures Based on Correlations, Deformable Template Models.

Context Dependent Classification: Markov Chain Models, Hidden Markov Models.

Clustering Algorithms: Clustering Algorithms Based on Graph Theory, Competitive Learning Algorithms: Supervised Learning Vector Quantization.

TEXT BOOKS:

1. S Theodoridis and K Koutroumbas ,"Pattern Recognition", 4th Edition, Academic Press, 2009.
2. C Bishop ," Pattern Recognition and Machine Learning" ,Springer , 2006.

SUGGESTED READINGS:

1. Theodoridis & Koutroumbas, **“**Pattern Recognition**”,** Academic Press, 4th Edition,2014.

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CS 482

BIO INFORMATICS

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To understand the basic concepts.
2. To search information, visualize it.
3. To learn various bioinformatics algorithms.
4. To understand data mining techniques.
5. To study various pattern matching techniques.

Course Outcomes:

After completion of the course, student should be able to:

1. Have a basic idea of BioInformatics.
2. Retrieve information using various algorithms.
3. Apply data mining and pattern matching techniques.
4. Sequence the databases.
5. Do modeling and simulation.
6. Understand social, legal, and privacy implications of electronic storage and sharing of biological information.

UNIT I
Introductory concepts:
The Central Dogma – The Killer Application – Parallel Universes – Watson's Definition – Top Down Versus Bottom up – Information Flow – Convergence – Databases – Data Management – Data Life Cycle – Database Technology – Interfaces – Implementation – Networks – Geographical Scope – Communication Models – Transmissions Technology – Protocols – Bandwidth – Topology – Hardware – Contents – Security – Ownership – Implementation – Management.

UNIT II
Search engines, visualization and algorithms:
The search process – Search Engine Technology – Searching and Information Theory – Computational methods – Search Engines and Knowledge Management – Data Visualization – sequence visualization – structure visualization – user Interface –Animation Versus simulation – General Purpose Technologies - Exhaustive search – Greedy – Dynamic programming – divide and Conquer – graph algorithms.

UNIT III
Statistics and data mining:
Statistical concepts – Microarrays – 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 – 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.

UNIT IV
Pattern matching:
Pairwise sequence alignment – Local versus global alignment – Multiple sequence alignment – Computational methods – 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.

UNIT V
Modeling and simulation:
Drug Discovery – components – process – Perspectives – Numeric considerations – Algorithms – Hardware – Issues – Protein structure – Abinitio Methods – Heuristic methods – Systems Biology – Tools – Collaboration and Communications – standards -Issues – Security – Intellectual property.

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.

SUGGESTED READINGS:
1. Neil C.Jones, PaveA. Pevzner, "An Introduction to, Bioinformatics Algorithms (Computational Molecular Biology)" , MIT Press 2004.

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CS 483

MACHINE LEARNING

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Understand the basic underlying concepts for supervised discriminative and generative learning.
2. Understand the concepts of cross-validation and regularization, be able to use them for estimation of algorithm parameters.
3. Characterize machine learning algorithms as supervised, semi-supervised, and unsupervised.
4. Understand algorithms for learning Bayesian networks.
5. Understand genetic algorithm , operators and programming techniques.
6. Understand and apply unsupervised algorithms for clustering.

Course Outcomes:

After completion of the course, student should be able to:

1. Understand a wide variety of learning algorithms.
2. Understand how to apply a variety of learning algorithms to data.
3. Have an understanding of the strengths and weaknesses of many popular machine learning approaches.
4. Understand how to perform evaluation of learning algorithms and model selection.
5. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
6. Gets a knowledge of clustering concepts.

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

Some Basic Statistics: Averages, Variance and Covariance, The Gaussian.
The Bias-Variance Tradeoff Bayesian learning: Introduction, Bayes theorem, Bayes Optimal Classifier, Naive Bayes Classifier.

Graphical Models: Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm.

UNIT IV

Evolutionary Learning: Genetic Algorithms, Genetic Operators.
Genetic Programming Ensemble learning: Boosting, Bagging.
Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis

UNIT V

Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison.

TEXT BOOKS:

1. Tom M. Mitchell, "Machine Learning ",MacGraw 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. Galit Shmueli, Nitin R Patel, Peter C Bruce, "Data Mining for Business Intelligence", Wiley India Edition, 2007.
3. Rajjall Shinghal, "Pattern Recognition ", Oxford University Press, 2006.

CS 484

BUSINESS INTELLIGENCE

Instruction	4L per week
Duration of SEE	3 Hours
SEE	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. This course focuses on how to design and build a Business Intelligence solution.
2. Students will also learn how to design and build a Data Warehouse
3. Students can develop their own projects within collaborative teams or can be assigned an existing data source to develop a project.
4. To ensure success during the implementation phase, students will plan for and gather business requirements, as well as design the data warehouse in order to develop an effective BI plan.

Course Outcomes:

After completion of the course, student should be able to:

1. Design and implementation of OLTP, OLAP and Warehouses.
2. Use ETL concepts, tools and techniques to perform Extraction, Transformation, and Loading of data.
3. Report the usable data by using various reporting concepts, techniques/tools, and use charts, tables.
4. Use Analytics concepts like data mining, Exploratory and statistical techniques for predictive analysis in Business Intelligence.
5. Acquire the knowledge of data visualization techniques.
6. Get a view of future trends of business intelligence.

UNIT I

An Overview of Business Intelligence, Analytics, and Decision Support-Changing Business Environments and Computerized Decision Support, A Framework for Business Intelligence (Bl), Intelligence Creation, Use, and Bl Governance, Transaction Processing Versus Analytic Processing, Successful Bl Implementation, Analytics Overview, Brief Introduction to Big Data Analytics.

UNIT II

Data Warehousing Definitions and Concepts, Data Warehousing Architectures, Data Integration and the Extraction, Transformation, and Load (ETL) Processes, Data Warehouse Development, Data Warehousing Implementation Issues, Real-Time Data Warehousing, Data Warehouse Administration, Security Issues, and Future Trends, Business Reporting, Visual Analytics, and Business Performance Management- Business Reporting Definitions and Concepts, Data and Information Visualization, Different Types of Charts and Graphs, The Emergence of Data Visualization and Visual Analytics, Performance Dashboards, Business Performance Management, Performance Measurement.

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UNIT III

Data Mining- Data Mining Concepts and Applications, Data Mining Applications, Data Mining Process, Data Mining Methods, Data Mining Software Tools, Data Mining Privacy Issues, Myths, and Blunders, Text and Web Analytics, Text Analytics and Text Mining Overview- Natural Language Processing, Text Mining Applications, Text Mining Proces, Sentiment Analysis, Web Mining Overview, Search Engines, Web Usage Mining (Web Analytics), Social Analytics.

UNIT IV

Big Data and Analytics, Definition of Big Data- Fundamentals of Big Data Analytics, Big Data Technologies, Data Scientist, Big Data and Data Warehousing, Big Data Vendors, Big Data And Stream Analytics, Applications of Stream Analytics.

UNIT V

Business Analytics: Emerging Trends and Future Impact- Location-Based Analytics for Organizations, Analytics Applications for Consumers, The Web 2.0 Revolution and Online Social Networking, Cloud Computing and Bl, Impacts of Analytics In Organizations, Issues of Legality, Privacy, and Ethics, An Overview of the Analytics Ecosystem.

TEXT BOOKS:

1. Ramesh Sharda Oklahoma State University, et.all "BUSINESS INTELLIGENCE" Pearson education, Third edition, 2014.
2. R.N. Prasad, Seema Acharya, "Fundamentals of Business Analytics", Weily First Edition, 2011.

SUGGESTED READINGS:

1. William Inmon, "Building the Data Warehouse", Wiley publication 4 th edition, 2004.
2. Efrem G. Mallach, "Decision Support And Data Warehouse Systems", 1st Edition Publisher: Tata McGraw-Hill Education,. ISBN-10: 0072899816, 2002.
3. Efraim Turban, Ramesh Sharda, Dursun Delen, David King, "Business Intelligence", ISBN-10: 013610066X Publisher: Prentice Hall.ISBN-13: 9780136100669, 2010.
4. Dorian Pyle, "Business Modeling and Data Mining", Elsevier Publication MK, 2003.
5. Reema Thareja, "Data Warehouse", Publisher: Oxford University Press, 2009.

Professor and Head Department

ME 472

INTELLECTUAL PROPERTY RIGHTS

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Course Objectives:

1. To introduce fundamental aspects of IP
2. Introducing all aspects of IPR acts.
3. Creating awareness of multi disciplinary audience
4. Creating awareness for innovation and its importance
5. Exposing to the changes in IPR culture
6. Awareness about techno-business aspects of IPR

Course Outcomes:

After completion of the course, student should be able to:

1. Respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IP. .
6. Capable of converting creativity into IP 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:

4. Cronish W.R1 Intellectual Property; Patents, copyright, Trad and Allied rights, Sweet & Maxwell, 1993.
5. P. Narayanan, Intellectual Property Law, Eastern Law Edn., 1997.
6. Robin Jacob and Daniel Alexander, A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs, Sweet, Maxwell 4th Edition.

CE-422

DISASTER MITIGATION AND MANAGEMENT

Instruction	4 Periods per week
Duration of Main Examination	3 Hours
Main Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

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, mechanism causes, consequences and mitigation measures of the various natural disasters including hydro metrological and geological based disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters including chemical, biological and nuclear warfare agents.
4. To equip the students with the knowledge of various chronological phases in the disaster management cycle.
5. To create awareness about the disaster management framework and legislations in the context of national and global conventions.
6. To enable students to understand the applications of geospatial technologies like remote sensing and geographical information systems in disaster management.

Course Outcomes:

After completion of the course, student should be able to:

1. Analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at local level
2. 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 natural and human induced disasters for the participatory role of engineers in disaster management.
4. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans
5. Understand various participatory approaches/strategies and their application in disaster management
6. Understand the concepts of remote sensing and geographical information systems for their effective application in disaster management.

UNIT-I

Introduction to Natural, human induced and human made disasters – Meaning, nature, types and effects; International decade of natural disaster reduction (IDNDR); International strategy of natural disaster reduction (ISDR).

UNIT-II

Natural Disasters– Hydro meteorological disasters: Causes, impacts, Early warning systems, structural and non-structural measures for floods, drought and cyclones; Tropical cyclones: Overview, cyclogenesis, drought monitoring and management.; Geographical based disasters: Earthquakes and Tsunami- Overview, causes, impacts, zoning, structural and non-structural mitigation measures; Tsunami generation; Landslides and avalanches: Overview, causes, impacts, zoning and mitigation measures. Case studies related to various hydro meteorological and geographical based disasters.

UNIT III

Human induced hazards: Risks and control measures in a chemical industry, Causes, impacts and mitigation measures for chemical accidents, chemical disaster management, current status and perspectives; 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 and traffic accidents.

UNIT IV

Use of remote sensing and GIS in disaster mitigation and management; Scope of application of ICST (Information, communication and space technologies in disaster management, Critical applications& Infrastructure; Potential application of Remote sensing and GIS in disaster management and in various disastrous conditions like earthquakes, drought, Floods, landslides etc.

UNIT V

Concept of Disaster Management: Introduction to disaster management, Relationship between Risk, vulnerability and a disaster, Disaster management cycle, Principles of disaster mitigation: Hazard identification and vulnerability analysis, Early warning systems and forecasting; Infrastructure and development in disaster management; Disaster management in India: National disaster management framework at central, state, district and local levels. Community based disaster management.

TEXT BOOKS :

1. Rajib, S and Krishna Murthy, R.R (2012), "Disaster Management Global Challenges and Local Solutions" Universities Press Hyderabad.
2. Notes / Reading material published by National Disaster Management Institute, Ministry of Home Affairs, Govt. of India.

SUGGESTED READING:

1. Navele, P & Raja, C.K. (2009), Earth and Atmospheric Disasters Management, Natural and Manmade. B.S. Publications, Hyderabad.
2. Fearn-Banks, K (2011), Crises computations approach: A case book approach. Route ledge Publishers, Special Indian Education, New York & London.
3. Battacharya, T. (2012), Disaster Science and Management. Tata McGraw Hill Company, New Delhi.

ME 464

Entrepreneurship (Elective – II) (for Mech, Prod, Civil, EEE & CSE)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To understand the essence of Entrepreneurship
2. To know the environment of industry and related opportunities and challenges
3. To know the concept a procedure of idea generation
4. To understand the elements of business plan and its procedure
5. To understand project management and its techniques
6. To know behavioral issues and Time management

Outcomes: After completing this course, students will be able to:

1. Apply the entrepreneurial process
2. Analyze the feasibility of a new business plan and preparation of Business plan
3. Evaluate entrepreneurial tendency and attitude
4. Brainstorm ideas for new and innovative products or services
5. Use project management techniques like PERT and CPM
6. 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", Tata Me Graw Hill Publishing Company Ltd., 5lh Ed., 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 (AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHEME OF INSTRUCTION AND EXAMINATION

M.TECH (CSE) –REGULAR (CBCS)

I- SEMESTER

Course Code	Course	No. of Hrs./Week		Marks for		Total Marks	Credits
		L	T/P/S	Internal Assessment	End Exam		
16CSC101	Advanced Algorithms	3	1	30	70	100	4
16CSC102	Advanced Operating Systems	3	1	30	70	100	4
16CSC103	Advanced Databases	3	1	30	70	100	4
16CSE11X	Elective 1	3	--	30	70	100	3
16CSE12X	Elective 2	3	--	30	70	100	3
16CSE13X	Elective 3	3	--	30	70	100	3
16CSC104	ADB Lab (Lab-I)	---	3	50	-	50	2
16CSC105	Seminar - I	---	3	50	-	50	2
16EG104	*Soft Skills Lab	---	2	* Non-Credits			
Total		18	11	280	420	700	25

* L: Lecture T: Tutorial P: Practical

II-SEMESTER

Course Code	Course	No. of Hrs./Week		Marks for		Total Marks	Credits
		L	T/P/S	Internal Assessment	End Exam		
16CSC201	Advanced Network Technologies	3	1	30	70	100	4
16CSC202	Big Data Analytics	3	1	30	70	100	4
16CSC203	Advanced Software Engineering	3	1	30	70	100	4
16CSE24X	Elective 4	3	---	30	70	100	3
16CSE25X	Elective 5	3	---	30	70	100	3
16CSE26X	Elective 6	3	---	30	70	100	3
16CSC204	Big Data Analytics Lab (Lab-II)	---	3	50	-	50	2
16CSC205	Seminar - II	---	3	50	-	50	2
16CSC206	Mini Project		2	50	-	50	1
Total		18	11	330	420	750	26

LIST OF ELECTIVES COURSES

ELECTIVE – I		ELECTIVE - II	
16CSE111	Data Mining	16CSE121	Internet of Things
16CSE112	Artificial Intelligence	16CSE122	Research Methodologies in Computer Science
16CSE113	Machine Learning	16CSE123	Business Intelligence
ELECTIVE – III		**ELECTIVE – IV**	
16CSE131	Software Quality Assurance&Testing	16CSE241	Adhoc and Sensor Networks
16CSE132	Mobile Computing	16CSE242	Embedded Systems
16CSE133	Natural Language Processing	16CSE243	Image Processing
ELECTIVE – V		**ELECTIVE – VI**	
16CSE251	Cloud Computing	16CSE261	Software Reuse Techniques
16CSE252	Soft Computing	16CSE262	Storage Management
16CSE253	High Performance Systems	16CSE263	Streaming Technology

III-SEMESTER

Course Code	Course		Marks for		Total Marks	Credits
			Internal Assessment	End Exam		
16CS C301	Project Seminar	I. Problem formulation and submission of synopsis within 8 weeks from the commencement of 3rd semester. -----------**(50 Marks)** II. Preliminary work on Project Implementation.--------**(50 Marks)**	100	----	100	6
Total			100		100	6

IV-SEMESTER

Course Code	Course	Marks for		Total Marks	Credits
		Internal Assessment	End Exam		
16CSC 401	Project Work and Dissertation	100	100	200	12
Total				200	12

Detailed Syllabus

Course Code: 16CSC101

ADVANCED ALGORITHMS

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L + 1T Periods per week	30	3 Hours	70	4

Course Objectives:

At the end of the course student should

1. Develop mathematical skills for algorithm design, analysis, evaluation and computational cost
2. Develop the skills to design and implement efficient programming solutions to various problems
3. Develop data structure techniques for various aspects of programming

Course Outcomes:

After completion of this course, the student will be able to

1. Design, analyze and evaluate algorithms
2. Develop the skills to design and implement efficient programming solutions to various problems
3. Use data structure techniques for various aspects of programming
4. Gains knowledge in text processing, security algorithms and computational geometry.
5. Design algorithms for real time problems.

UNIT- I

Algorithm Analysis: Asymptotic Notation, Amortization, Basic Data Structure: Stacks and Queues, Vectors, Lists and Sequences, Trees, Priority Queues, Heaps, Dictionaries and Hash Tables ,Search Trees and Skip Lists: Ordered Dictionaries and binary Search Trees, AVL trees, Bounded-Depth Search Trees.

UNIT-II

Fundamental Techniques: The Greedy Method, Divide and Conquer, Dynamic Programming, Graphs: The Graph abstract data Type, Data Structures for Graphs, Graph Traversal, Directed Graphs.

UNIT-III

Weighted Graphs: Single Source Shortest Paths, All pairs Shortest Paths, Minimum Spanning Trees. Network Flow and Matching: Flows and Cuts, Maximum Flow, Maximum Bipartite Matching, Minimum Cost Flow

UNIT-IV

Text processing: Strings and Pattern Matching algorithms, Tries, Text Compression, Text Similarity testing. Number Theory and Cryptography: Fundamental Algorithms involving numbers, Cryptographic Computations, Information Security Algorithms and Protocols.

UNIT-V

Computational Geometry: Range Trees, Priority Search Trees, Quad trees and k-d Trees, Convex Hulls, N-P Complete.

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Suggested Reading:

1. M.T.Goodrich, R.Tomassia, "**Algorithm design – Foundations, Analysis, and Internet Algorithms**", John Wiley, 2002
2. E Horrowitz, S salmi, S Rajasekaran, "**Fundamentals of Computer Algorithms**", Second Edition, University Press, 2007

Reference Books:

1. Aho, A V Hopcraft Ullman JD, "**The Design and analysis of computer Algorithms**", Pearson Education, 2007
2. Hari Mohan Pandy, " **Design analysis amd Algorithms**", University Science press, 2009
3. Cormen, Lieserson, Rivest, "**Introduction to Algorithms**", 2nd Edition, PHI, 2003

Course Code: 16CSC102

ADVANCED OPERATING SYSTEMS

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L + 1T Periods per week	30	3 Hours	70	4

Course Objectives:

At the end of the course student should

1. Understand globalviewofdistributedoperatingsystemsandprovidestheoreticalfoundation fordistributed systems.
2. Study the characteristics of OS for Multiprocessor and Multicomputer.
3. Learn the issues related to designing OS.
4. Understand Security&protectionincomputersystemsandmechanismsusedinbuilding multiprocessoroperatingsystems.
5. Explore management of different resourcesin distributed systems.

Course Outcomes:

After completion of this course, the student will have

1. Knowledge about advanced concepts in OS
2. Ability to develop OS for distributed systems
3. Ability to implement protection and security for distributed systems
4. Ability to develop Fault tolerant systems
5. Ability to develop multiprocessor operating systems
6. Ability to develop modules for Real time operating systems

UNIT- I

Overview of Advanced O.S: Design approaches, Motivation, Types of Advanced OS.
Architecture: Motivations, System Architecture types,Issues in Distributed Operating system.
Theoretical Foundations: Limitations, Lamport's logical clock,vector Clocks, Global state, Cuts, Termination Detection.

UNIT- II

Distributed Mutual Exclusion: Classificaton, Requirements, Performance, Simple Solution, Non-token-based Algorithms- Lamport's Algorithm, Recart-agrawala Algorithm, Token-based Algorithms - Suzuki-kasami's broadcast algorithm, Singhal's Heuristic Algorithm.
Distributed Deadlock Detection: Resource Vs. Communication Deadlocks, Graph-Theoretic model Strategies to handle Deadlocks, Issues in Deadlock detection and Resolution, Control organizations, Centralized Deadlock detection Algorithms- Completely centralized, Ho-Ramamoorthy Algorithms, Distributed Deadlock detection Algorithms - Path-Pushing, Edge-Chasing Algorithms. Hierarchical Deadlock detection Algorithms – Menasce - Muntz, Ho-Ramamoorthy Algorithm.
Agreement Protocols: System model, Classification of agreement problems, Solutions to Byzantine agreement problems.

UNIT- III

Distributed File Systems: Mechanisms for building DFSs, Design Issues, Case studies - Sun NFS, and Sprite File System.
Distributed Shared Memory: Algorithms for implementing DSMs, Memory Coherence, and Coherence Protocols, Design Issues, Case Studies - IVY.

Distributed Scheduling: Issues in Load Distribution, Components of a load distribution algorithm, Stability,Load Distributing Algorithms,Performance.Task migration.

UNIT- IV

Recovery: Classification of failures, backward and Forward Error Recovery. Backward Error Recovery, Recovery in concurrent systems, Consistent set of Checkpoints Synchronous and Asynchronous Checkpointing and Recovery.

Protection and Security: Access Matrix Model, Implementation of access matrix, Introduction to Data Security. Private Key, Public key, Kerberos System.

UNIT- V

Multiprocessor Operating System: Motivation, Basic Multiprocessor System Architecture, Interconnection Networks for Multiprocessor System, caching, Hypercube Architecture. Threads, Process Synchronization, Processor Scheduling, memorymanagement

Real Time Operating System : Fundamentals, real time multitasking, embedded application, preemptive task scheduling, inter-task communication and synchronization.

Suggested Reading:

1. M Singhal and NG Shivaratri , "**Advanced Concepts in Operating Systems**", Tata McGraw Hill Inc, 2001

Reference Books:

1. A S Tanenbaum, "**Distributed Operating Systems**", Pearson Education Asia, 2001
2. Pradeep K. Sinha, "**Distributed operating system concepts &Design**", PHI,2003

Course Code: 16CSC103

ADVANCED DATABASES

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L + 1T Periods per week	30	3 Hours	70	4

Course Objectives:

At the end of the course student should

1. Design high-quality relational databases and database applications.
2. Translate complex conceptual data models into logical and physical database designs.
3. Gain an understanding of Oracle11g and XML
4. Have a outline knowledge about Parallel and Distributed Databases 5. Gain experience in Performance Tuning

Course Outcomes:

After completion of this course, the student will be able to

1. Analyze and evaluate modeling and development methods/techniques in Object-based Databases
2. Understand and analyze query processing and optimization.
3. Understand how distributed and parallel databases are implemented, and how applications can be designed for those databases.
4. Gain insight into some advanced topics in database such as Performance Tuning, spatial databases, temporal databases.
5. Understand and implement cloud-based databases
6. Develop applications for mobility and personal databases.

UNIT- I

Object Based Databases: Overview, complex Data Types, Structured Types and Inheritance in SL, table Inheritance, Array and Multiset Types in SQL, Object –Identity and Reference Types in SQL, Implementing O-R features, Persistent Programming Languages, Object- Relational Mapping, Object – Oriented versus Object-Relational.

UNIT-II

XML: Motivation, Structure of XML data, XML Document schema, Querying and Transformation, Application Program Interface to XML, Storage of XML data, XML applications.

UNIT-III

Query processing:

Overview, Measures of Query Cost, Selection operating, sorting, Join Operation, Other Operations, Evaluation of Expressions.

Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expressing Results, Choice of Evaluation plans, Materialized Views.

UNIT-IV

Parallel Databases: Introduction, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Interoperation Parallelism Query Optimization, Design of Parallel Systems.

Distributed Databases: Homogenous and Heterogeneous Databases, distributed data storage, Distributed Transactions, Commit Protocols, concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases, cloud Based Databases, Directory systems.

UNIT-V

Advanced Application development: Performance Tuning, Performance Benchmarks Other Issues in Application Development, Standardization

Spatial and Temporal Data and Mobility: Motivation, Time in Databases, spatial and Geographical Data, Multimedia Databases, Mobility and Personal databases

Suggested Reading:

1. Abraham Silbershatz, Henry F Korth, S Sudharshan, "**Database System Concepts**", McGraw Hill International Edition, Sixth Edition, 2010
2. ElmasriNavathe, Somayajulu, Gupta, " **Fundamentals of Database Systems**", Pearson Education, Fourth Edition, 2006.

Reference Books:

1. CJ Date, A Kannan, S Swamynathan, "**An Introduction to database Systems**", Pearson Education, Eight Edition, 2006
2. Ramakrishna, Gehrke, "**Database Management",** International Edition, Third Edition, 2003

Course Code: 16CSE111

DATA MINING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:
The objectives of this course are
1. To introduce the basic concepts of Data Mining, Challenges and Applications
2. To study various data mining algorithms
3. To discuss about the data mining algorithms solving real time problems.

Course Outcomes:
After completion of this course, the student will be able to
1. Understand basic concepts related to Data mining, data quality and metrics
2. Identify the applications of Data Mining
3. Identify an understand working of various Data Mining Techniques
4. Apply Data Mining Techniques to solve real world problems
5. Analyze the complexity, limitation of application of various Data Mining algorithms
6. Evaluate various Data mining Technologies

UNIT - I
Introduction: Challenges, Origins of Data Mining and Data Mining Tasks. Data**:** Types of Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity, OLAP and Multidimensional Data Analysis.

UNIT - II
Classification: Preliminaries, General Approach to Solving a Classification Problem, Decision Tree Induction-Model Over fitting, evaluating the Performance of a Classifier, Rule-Based Classifier.

UNIT - III
Classification: Nearest-Neighbor classifiers, Bayesian Classifiers, Artificial Neutral Networks, Support Vector Machine, Ensemble Methods, Class Imbalance Problem, Multiclass Problem.

UNIT - IV
Association Analysis: Problem Definition, Frequent Item Set Generation, Rule Generation, Compact Representation of Frequent Item Sets, Alternative Methods for Generating Frequent Item Sets, FP-Growth Algorithm, Evaluation of Association Patterns, Effect of Skewed Support Distribution.

UNIT - V
Cluster Analysis: Overview, K-means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation on Characteristics of Data, Clusters and Clustering Algorithms.

Suggested Reading:

1. Pang-Ning Tan. Michael Steinbach, Vipin Kumar, "**Introduction to Data Mining**", Pearson Education, 2008.
2. K.p.Soman, ShyamDiwakar, V.ajay, “**Insight into data Mining theory and Practice**”, PHI, 2010

Reference Books:

1. Arun K Pujari, "**Data Mining Techniques**", University Press. 2ndEdn, 2009.
2. VikrarmPudi, P. Radha Krishna, "**Data Mining**", Oxford University Press, 1st edition, 2009.
3. Sumathi, S N Sivanandam, "**Introduction to Data Mining and its Applications** ", Springer.

Course Code: 16CSE112

ARTIFICIAL INTELLIGENCE

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

CourseObjectives:

At the end of the course student should will have

1. The basic principles of Artificial Intelligence.
2. Various knowledge representation schemes in Artificial Intelligence
3. The concepts needed to build an Artificial Intelligence systems: logic programming, probability, Learning and Artificial Neural Networks.

CourseOutcomes:

Upon successful completion, students can comprehend

1. Describes the Basicscomponents and major techniques behind Artificial Intelligence Systems.
2. Understands the Knowledge formulations representation, reasoning techniques and semantic tableau systems.
3. Understands architecture of an experts system, tools and applying uncertainty measures to solve real world problems
4. Analyzes machine learning paradigms, various learning strategies and understands the differentiate learning strategies
5. Exposure to various artificial neural networks and its functionality.
6. The concepts needed to build an Artificial Intelligence Systems advanced knowledge representation techniques and fundamentals of Natural language processing.

UNIT-I

Introduction: History,Intelligent Systems, Foundationsof AI,SubareasofAI,Applications
ProblemSolving-State-SpaceSearchandControlStrategies:Introduction,GeneralProblemSolving, CharacteristicsofProblem,ExhaustiveSearches,HeuristicSearchTechniques,Iterative-Deepening A*, Constraint Satisfaction.

GamePlaying, Bounded Look-ahead Strategy and useof Evaluation Functions, Alpha-BetaPruning.

UNIT -II

LogicConceptsandLogicProgramming:Introduction,PropositionalCalculus,PropositionalLogic, NaturalDeductionSystem,AxiomaticSystem,SemanticTableauSysteminPropositionalLogic, Resolution Refutation inPropositionalLogic,PredicateLogic, LogicProgramming.

KnowledgeRepresentation:Introduction,ApproachestoKnowledgeRepresentation,Knowledge RepresentationusingSemanticNetwork,ExtendedSemanticNetworksforKR,Knowledge Representation usingFrames.

UNIT -III

ExpertSystemandApplications:Introduction,PhasesinBuildingExpertSystems,ExpertSystem Architecture,ExpertSystemsversusTraditionalSystems,TruthMaintenanceSystems,Applicationof ExpertSystems, Useof Shells andTools

UncertaintyMeasure-ProbabilityTheory:Introduction,ProbabilityTheory,BayesianBelief Networks,CertaintyFactorTheory,Dempster-Shafer Theory

UNIT –IV

Machine-Learning Paradigms: Introduction. Machine Learning Systems.Supervised and UnsupervisedLearning.InductiveLearning.LearningDecisionTrees(SuggestedReading2), Deductive Learning. Clustering, SupportVectorMachines.

ArtificialNeuralNetworks:Introduction,ArtificialNeuralNetworks,Single-LayerFeed-Forward Networks,Multi-LayerFeed-ForwardNetworks,Radial-BasisFunctionNetworks,DesignIssuesof Artificial Neural Networks,RecurrentNetworks

UNIT -V

Advanced Knowledge Representation Techniques:Case Grammars,Semantic Web NaturalLanguageProcessing:Introduction,SentenceAnalysisPhases,GrammarsandParsers,Types ofParsers, SemanticAnalysis, Universal NetworkingKnowledge.

Suggested Reading:

1. SarojKaushik."**ArtificialIntelligence**",CengageLearning. 2011.
2. Russell, Norvig,"**Artificialintelligence, A Modern Approach"**, Pearson Education, Second Edition2004.

Reference Books:

1. Rich, Knight, Nair,"**Artificialintelligence**",TataMcGraw Hill, ThirdEdition 2009.

Professor and Head Department

Course Code: 16CSE113

MACHINE LEARNING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

CourseObjectives:

The main objectives of this course are

1. To discuss basic concepts ofMachineLearning,problems andtheotherconceptssucha algorithms, heuristics, solution spaces and relatethem tobrute forcesearching.
2. To study mathematical conceptsrelated tothe machine learning algorithms.
3. To demonstratefamiliaritywith various techniques in MachineLearning techniquesand theirapplications as wellas general questions related toanalyzing andhandling large data sets.

CourseOutcomes:

Upon successful completion of the course, student

1. Acquire the basic knowledge ofMachineLearning, identify algorithms,machine learning problems
2. Gets ability toapplytheknowledge ofcomputingandmathematics appropriatetothe discipline
3. Identifiesvariousmachine learning techniques such asdecisiontree, artificialneural networks,Bayesian learning, geneticalgorithms,clusteringandclassification algorithmsetc. andtheir applications.
4. Gets working knowledgeof applyingtheML algorithmsto the availablelarge data setswith the available simulation packages suchasWEKA ,Clementine etc.
5. Analyze the Machine Learning algorithms
6. Evaluate various Machine Learning Algorithms

UNIT-I

Introduction:Learning, Types ofMachine Learning. Conceptlearning:Introduction,VersionSpacesandtheCandidateEliminationAlgorithm.Learning with Trees: Constructing DecisionTrees, CART, ClassificationExample.

UNIT-II

LinearDiscriminants:ThePerceptron,Linear Separability.Linear RegressionMultilayer Perceptron(MLP): Going Forwards, Backwards,MLPin practices, Derivingback,Propagation SupportVectorMachines: Optimal Separation,Kernels.

UNIT-III

Some Basic Statistics: Averages, VarianceandCovariance, TheGaussian.The Bias-Variance Tradeoff, Bayesianlearning: Introduction, Bayestheorem,BayesOptimal Classifier, Naive BayesClassifier.

GraphicalModels:Bayesiannetworks,ApproximateInference,MakingBayesianNetworks, Hidden Markov Models,The Forward Algorithm.

UNIT-IV

Evolutionary Learning: Genetic Algorithms, GeneticOperators. GeneticProgrammingEnsemble learning: Boosting, Bagging.

Dimensionality Reduction:LinearDiscriminant Analysis, PrincipalComponent Analysis

UNIT-V

Clustering: Introduction,SimilarityandDistanceMeasures,Outliers,HierarchicalMethods,Partitional algorithms,ClusteringLargeDatabases,ClusteringwithCategoricalAttributes, Comparison.

SuggestedReading:

1. TomM. Mitchell,"**MachineLearning** ",MacGraw Hill, 1997.
2. Stephen Marsland, "**Machine Learning - AnAlgorithmic Perspective**", CRCPress,2009.

Reference Books:

1. MargaretH Dunham, "**DataMining**",Pearson Edition,2003.
2. GalitShmueli,NitinRPatel,PeterCBruce,"**DataMiningforBusinessIntelligence**",Wiley India Edition,2007.
3. RajjallShinghal, "**Pattern Recognition**",OxfordUniversityPress, 2006.

Course Code: 16CSE121

INTERNET OF THINGS

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

CourseObjectives:

At the end of the course student should

1. Understand vision and Introduction to IoT.
2. Understand IoT Market perspective.
3. Explore Data and Knowledge Management and use of Devices in IoT Technology.
4. Understand State of the Art – IoT Architecture.
5. Explore the Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

CourseOutcomes:

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

1. Understand the vision of IoT from a global context.
2. Determine the Market perspective of IoT.
3. Use of Devices, Gateways and Data Management in IoT.
4. Building state of the art architecture in IoT.
5. Understand Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

UNIT-I

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.

UNIT-II

M2M to IoT – A Market Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. **M2M to IoT-An Architectural Overview**– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT-III

M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

UNIT-IV

IoT Architecture-State of the Art – Introduction, State of the art,**Architecture Reference Model-** Introduction, Reference Model and architecture, IoT reference Model

UNIT-V

IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Real-World Design Constraints-** Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.**Industrial Automation-** Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things,**Commercial Building Automation-** Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Suggested Reading:

1. 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.

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, "**Internet of Things (A Hands-on-Approach)**", 1stEdition, VPT, 2014.
2. Francis daCosta, "**Rethinking the Internet of Things: A Scalable Approach to Connecting Everything**", 1st Edition, Apress Publications, 2013

Course Code: 16CSE122

RESEARCH METHODOLOGIES IN COMPUTER SCIENCE

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:
At the end of the course student should

1. Understand epistemology, objectives and types of research.
2. Collect data, analyze and report the results.
3. Apply latest computer methodologies to the research problems.

Course Outcomes
Upon the successful completion of the course student will be able to

1. Identify design and formulate a research problem
2. Explore different data collection methods and analyze data
3. Use different CI methodologies to solve a problem.
4. Test, Analyze and interpret the data.
5. Write a report of the findings of research problems.

UNIT- I
Introduction to Research Methods:, Evolutionary Epistemology, Scientific Methods, Hypotheses Generation and Evaluation, Code of Research Ethics, Issues related to plagiarism, collaborative models and ethics, acknowledgments. Intellectual Property Rights: Copy rights, copy left, Patents, Industrial designs, Trademarks. Definition and Objectives of Research, Various Steps in Scientific Research, Types of Research, Research Purposes, Research Design, Survey Research, Case Study Research.

UNIT- II
Data: Methods of Data collection, Description and Analysis of Data, Sampling Design, Role of Statistics for Data Analysis, Functions of Statistics, Estimates of Population, Parameters, Parametric V/s Non Parametric methods, Descriptive Statistics, Points of Central tendency, Measures of Variability, Measures of relationship, Inferential Statistics- Estimation, Hypotheses Testing.

UNIT-III
Data Analysis: Deterministic and random data, Uncertainty analysis, Tests for significance, Chi-square, t-test, Regression modeling, Direct and Interaction effects, ANOVA, F-test, Time Series analysis, Correlation and Regression.
Computational Intelligence: Computational Intelligence Paradigms, Artificial Neural Networks, Evolutionary Computation, Swarm Intelligence, Artificial Immune Systems, Fuzzy Systems.
Epistemology: applications in AI, Software Engineering

UNIT-V
Research Reports, Ethics and Morals:Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report. Format of the

Research Report, Style of writing report, References / Bibliography / Webilography. Technical paper writing / Journal report writing, Writing Research Grant Proposal, Funding agencies

Suggested Reading:
1. C.R.Kothari, "**Research Methodology, Methods and Techniques"**, New age International Publishers, 2004
2. Andries P. Engelbrecht, "**Computational Intelligence An Introduction**", Wiley, 2nd Edition, 2007

Reference Books:
1. Chris Eaton, Dirk Deroos, Tom Deutsch, George Lapis, Paul Zikopoulos, "**Understanding Big Data Analytics for Enterprise class Hadoop and Streaming Data**" I Edition, TMH 2012.
2. R.Ganesan, "**Research Methodology for Engineers**", MJP Publishers, 2011
3. Y.P.Agarwal, "**Statistical Methods: Concepts, Application and Computation**", Sterling Publications Pvt.Ltd., New Delhi, 2004.
4. Vijay Upagade and AravingShende, "**Research Methodology**", S.Chand& Company Ltd. New Delhi, 2009.
5. **Statistical Methods** by S.P.Gupta.

Course Code: 16CSE123

BUSINESS INTELLIGENCE

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course, student

1. Gets familiarized with Business Intelligence methodologies
2. Learns data warehousing concepts
3. Get familiarized with business management
4. Learns data mining concepts and implementation of business intelligence

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Understand concepts of Data warehousing and data mining
2. Explore different changing scenarios in business intelligence
3. Learn analysis and reporting with available Business Intelligence software
4. Apply various data mining tool for Business Intelligence
5. Understand ethical and legal issues involved in Business Intelligence

UNIT- I

Introduction to Business Intelligence: Changing Business environments and computerized decision support, A framework for Business Intelligence, Intelligence creation and use in governance, transactional processing versus Analytical processing, successful Business Intelligence implementation, tools and techniques

UNIT -II

Data Warehousing: definition and concepts, DW process overview, Architectures, Data integration and extraction, transformation and load(ETL) processes, Implementation issues, Real time data warehousing.

UNIT -III

Business Reporting, Visual Analytics and Business Performance Management: Overview, strategies, performance measures, Methodologies, applications.

UNIT -IV

Data Mining for BI: Definitions, Methods, process, Text Mining: NLP, Text mining applications, process, tools, Web Mining: web mining process, methods.

UNIT -V

Business Intelligenceimplementation: Integration and emerging trends, issues of legality, ethics.

Suggested Reading:

1. Efraim Turban, Ramesh Sharda, DursunDelen, David King, Janine E. Aronson."**BusinessIntelligence**(2nd Edition)Paperback, 312 Pages, Published 2010 by Prentice Hall
2. David Loshin, "**Business Intelligence"** - The Savy Manager's Guide Getting Onboard with Emerging IT, Morgan Kaufmann Publishers, 2009.

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Course Code: 16CSE131

SOFTWARE QUALITY ASSURANCE AND TESTING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:
At the end of the course, student
1. Learns the importance of software quality assurance.
2. Gets knowledge about Quality tools in the Software development process.
3. Gains an insight to Software Testing.

Course Outcomes:
Upon successful completion of the course students would have
1. Gained Knowledge about Software Quality assurance.
2. Acquainted with various Quality tools.
3. Gained knowledge about Software Testing.
4. Learned techniques to improve the quality of their own software development.
5. Prepared a software quality plan for a software project.

UNIT-I
Software Quality, Quality Management, Software Quality Metrics, Product Quality Metrics, Process Quality Maintenance, Examples.

UNIT-II
Quality Too1s in Software Development, Seven Basic Tools, Check List, Pareto Diagram, Histogram, Run Charts, Scatter Diagram, Control Chart, Cause and Effect Diagram, Defect Removal, Effect Removal Effectiveness, Quality Planning, Cost Effectiveness of Phase Effect Removal.

UNIT-III
Software Testing Background, Software Development Process, Realities of Software Testing, Examining the Specification, Testing the s/w with Blinders on Examining the Code, Testing the s/ w with X-ray.

UNIT-IV
Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Website Testing, Automated Testing and Test Tools Bug Bashes & Beta Testing.

UNIT-V
Planning Your Test Effort, Writing & Tracking Test Cases, Reporting Measuring SQA.

Suggested Reading:

1. Stepen. H. Khan, "**Metrics and Models in Software Quality Engineering**", Pearson Education. India, 1995.
2. Ron Patton, "**Software Testing**", Sams Publishing, 2001.

Reference Books:

1. Boris Beizzer, "**Software Testing Techniques**" Sams Publishing, 2001.
2. Allan Gilles, "**Software Quality Theory & Management**", Thomson International Press, 1997.

Course Code: 16CSE132

MOBILE COMPUTING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course student should

1. Understands the basic concepts and principles in mobile computing.
2. Gets involved, in networks & systems issues for the design and implementation of mobile computing systems and applications.
3. Understands the key components and technologies involved and to gain hands on experiences in building mobile applications.

Course Outcomes:

After completion of this course, the student will be able to

1. Explain state-of-the-art wireless technologies.
2. Describe the functional architecture of Telecommunication Systems and Broad cast systems.
3. Distinguish various IEEE 802.11 standards of technologies in WLAN
4. Explain the various routing algorithms used in Adhoc-Networks and discuss their pros and cons.
5. Describe the publishing and accessing data and data delivery models and distributed file sharing Techniques and mobile Transaction models.

UNIT-I

Introduction: Wireless transmission, Frequencies for Radio Transmission, Signals, Antennas, Signal Propagation, Multiplexing, Modulations, Spread Spectrum, MAC SDMA, FDMA, TDMA, CDMA, Cellular Wireless Networks.

UNIT-II

Telecommunication Systems: GSM, GPRS, RA, Satellite Networks, Basics, Parameters and Configurations, Capacity Allocation, FAMA and DAMA, Broadcast Systems, DAB, DVB, CDMA and 3G.

UNIT-III

Wireless LAN: IEEE 802.11, Architecture, Services, MAC-Physical Layer, IEEE 802.11a-802.11b Standards, Bluetooth.

UNIT-IV

Routing Adhoc Network Routing Protocols: Adhoc Network Routing Protocols, Destination Sequenced Distance Vector Algorithm, Cluster Based Gateway Switch Routing, fish-eye state routing, Dynamic Source Routing, Adhoc on-demand Routing, Location Aided Routing, Zonal Routing Algorithm.

Mobile IP- Dynamic Host Configuration Protocol.

Traditional TCP-Classical TCP Improvements-WAP, WAP 2.0

UNIT-V

Publishing & Accessing Data in Air: Pull and Push Based Data Delivery models, Data Dissemination by Broadcast, Broadcast Disks, Directory Service in Air, Energy Efficient Indexing Scheme for Push Based Data Delivery.

File System Support for Mobility: Distributed File sharing for Mobility Support, Coda and other Storage Manager for Mobility Support.
Mobile Transaction and Commerce: Models for Mobile transaction, Kangaroo and Joey Transactions, Team Transaction. Recovery Model for Mobile Transactions.Electronic Payment and Protocols for Mobile Commerce.

Suggested Reading:

1. Jochen, M Schiller, "**Mobile Communications**", 2nd Edition Pearson Education, India, 2009.
2. KurnkumGarg "**Mobile Computing**", Pearson 2010.

Reference Books:

1. Asoke K Talukder,Roopa R Yavagal, "**Mobile Computing**", TMH 2008.
2. Raj Kamal,"**Mobile Computing**", Oxford, 2009.

Course Code: 16CSE133

NATURAL LANGUAGE PROCESSING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:
The objectives of this course are to:
1. Teach students the leading trends and systems in natural language processing
2. Make the students for understanding the concepts of morphology, syntax, semantics and pragmatics of the language
3. Teach the students for recognizing the significance of pragmatics for natural language understanding and structures.
4. Teach the students at least two methods of handling the pronoun relations and Information retrieval basics with the purpose of understanding the semantic interpretation.

Course Outcomes:
Upon successful completion of the students will be able to:
1. Understand the basics of terms like words and words forms of natural language processing and also the concepts of morphology, syntax, semantics and pragmatics of the language.
2. Recognize the significance of structures of the language and demonstrate the difference between the different parsing and ambiguity resolutions.
3. Describe them capable to describe the application based on natural language processing and to show the points of lexical syntactic, semantic and pragmatic processing.
4. Understand the basics of information retrieval and lexical resources and handling the pronoun relations, tagging, word net etc,.
5. Understand the applications of NLP and semantic issues.

UNIT - I
Words and Word Forms:Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields.

UNIT - II
Structures:Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.

UNIT - III
Meaning:Lexical Knowledge Networks, Wordnet Theory; Indian Language Wordnets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors; Coreferences.

UNIT - IV

Information Retrieval and Lexical Resources:Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger-Research Corpora.

UNIT - V

Applications of NLP:Sentiment Analysis; Text Entailment; Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval (CLIR).

Suggested Reading:

1. Jurafsky, Dan and Martin, James, "**Speech and Language Processing"**, Second Edition, Prentice Hall, 2008.

Reference Books:

1. L. Allen, James, "**Natural Language Understanding"**, Second Edition, Benjamin/Cumming, L995.
2. M. Charniack, Eugene, "**Statistical Language Learning**", MIT Press, L99H.
3. H. Jurafsky, Dan and Martin, James," **Speech and Language Processing**", Second Edition, Prentice Hall, M008.
4. Manning, Christopher and Heinrich, Schutze, "**Foundations of Statistical Natural Language Processing**", MIT Press, L999.
5. "**Natural Language Processing and Text Mining**", Kao, Springer, ISBN-978L846M8L75

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Course Code: 16CSC201

ADVANCED NETWORK TECHNOLOGIES

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:
The objectives of this course are:
1. To expose the students with advanced network concepts such as wireless MAC, BGP routing, MPLS, QOS scheduling and flow control, TCP variants etc.
2. To understand further details of computer networks
3. To focus on teaching research methods such as simulations and performance evaluation through assignments, projects and visits

Course Outcomes:
Upon successful completion of the course, students will be able to
1. Recollect the fundamental knowledge in computer networks
2. Identify and understand the advanced network concepts
3. Distinguish different flow control protocols
4. Identify, install and use network simulators
5. Conduct experiments to measure and analyze network performance
6. Investigate and review the network issues

UNIT-I:
Review of the Internet architecture, layering; wired and wireless MAC;

UNIT-II:
Intra- and inter-domain Internet routing, BGP, MPLS, MANETs;

UNIT-III:
Error control and reliable delivery, ARQ, FEC, TCP; congestion and flow control; QoS, scheduling;

UNIT-IV:
Mobility, mobile IP, TCP and MAC interactions, session persistence; multicast;

UNIT-V:
Internet topology, economic models of ISPs/CDNs/content providers; future directions

Suggested Reading:
1. Keshav, S. "**An Engineering Approach to Computer Networks**", Addition Wesley Professional.
2. Shivkumar, "**Network Architecture: Principles, Guidelines**", RPI 2006.
3. Peterson and Davie (book), "**Computer Networks: A Systems Approach**"
4. Relevant papers

Reference Books:
1. William Stallings, "**Data and Computer Communications**", 7th edition, Prentice Hall, 2004.
2. Andrew S. Tanenbaum, "**Computer Networks**", 4th edition, Prentice-Hall, Inc., 2003.
3. Larry L. Peterson and Bruce S. Davie, "**Computer Networks: A Systems Approach**", 3rd edition (2003), Morgan Kaufmann Publishers.

Course Code: 16CSC202

BIG DATA ANALYTICS

Instruction	Sessional Marks	Examination – Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of this course, students should be able to

1. Applying and understanding the big data flow for the actual projects.
2. Understands the lifecycle of the data analytics & big data ecosystem.
3. Implement the exploring and analysis of big data on a real world problem.
4. Acquires knowledge on the tools and techniques for solving big data analytics.
5. Aearns how to applying the mining techniques on big data.
6. Understand the Hadoop ecosystem.

Course Outcomes:

Upon successful completion of the course, students will

1. Have a clear idea about the big data flow and its ecosystem.
2. Be capable enough to apply the tools and techniques on big data.
3. Be able to apply data mining techniques for solving big data problems.
4. Be skilled to use the statistical tool and statistical methods that can be applied on big data.
5. Have a clear idea about how to represent the unstructured data in the data bases.
6. Grasp the Hadoop ecosystem.

UNIT-1

Introduction to Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics

Data Analytics Lifecycle: Data Analytics Lifecycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize, Case Study: Global Innovation Network and Analysis (GINA)

Review of Basic Data Analytic Methods Using R: Introduction to R, Exploratory Data Analysis, Statistical Methods for Evaluation

UNIT-II

Advanced Analytical Theory and Methods- Clustering: Overview of Clustering, K-means, Additional Algorithms

Advanced Analytical Theory and Methods-Association Rules: Overview, Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, An Example: Transactions in a Grocery Store, Validation and Testing , Diagnostics

UNIT-III

Advanced Analytical Theory and Methods- Regression : Linear Regression, Logistic Regression, Reasons to Choose and Cautions, Additional Regression Models

Advanced Analytical Theory and Methods-Classification: Decision Trees, Naïve Bayes, Diagnostics of Classifiers, Additional Classification Methods

UNIT-IV

Advanced Analytical Theory and Methods-Time Series Analysis: Overview of Time Series Analysis, ARIMA Model, Additional Methods

Advanced Analytical Theory and Methods-Text Analysis: Text Analysis Steps , A Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency--Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments, Gaining Insights

UNIT-V

Advanced Analytics: Technology and Tools-MapReduce and Hadoop: Analytics for Unstructured Data, The Hadoop Ecosystem, NoSQL

Advanced Analytics: Technology and Tools-In-Database Analytics: SQL Essentials, In-Database Text Analysis, Advanced SQL

The Endgame or Putting It All Together: Communicating and Operationalizing an Analytics Project, Creating the Final Deliverables, Data Visualization Basics

Suggested Reading:

1. EMC Education Services "**Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data**" Wiley Publishers
2. Michael Berthold, David J. Hand, "**Intelligent Data Analysis**", Springer, 2007.
3. Tom White " **Hadoop: The Definitive Guide**" Third Edition, Oreilly Media, 2011
4. Prajapati, V. "**Big data analytics with R and Hadoop"**. Packt Publishing Ltd, 2013

Reference Books:

1. Frank J. Ohlhorst, "**Big Data Analytics: Turning Big Data into Big Money**", Wiley Publishers
2. Tom Plunkett, Mark Hornick, "**Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop**", McGraw-Hill/Osborne Media (2013), Oracle press.
3. AnandRajaraman and Jeffrey David Ullman, "**Mining of Massive Datasets**", Cambridge University Press, 2012.
4. Glenn J. Myatt, "**Making Sense of Data**", John Wiley & Sons, 2007 5. Pete Warden, "Big Data Glossary", O'Reilly, 2011.

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Course Code: 16CSC203

ADVANCED SOFTWARE ENGINEERING

Instruction	Sessional Marks	Examination – Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The objectives of this course are

1. To familiarize students with software development process.
2. To learn software quality assessment.
3. To learn testing for optimum functionality at reasonable cost.
4. To understand the merits and demerits of different approaches in software engineering

Course Outcomes:

After completion of this course, student will be able to

1. Analyze various software engineering models and patterns generally used.
2. Choose the best model for the project based on the type of project.
3. Perform quality assessment testing on the software and measure the quality using various metrics.
4. Perform testing through various techniques to make sure the software project is optimal and to achieve this at a reasonable cost.
5. Design and conduct experiments, as well as to analyze and interpret data

UNIT-I

Introduction To Sotware Engineering: Software, What Is Software Engineering, Evolution Of Software Engineering Methodologies, Software Engineering Challenges,Software Engineering Principles,Software Process,Process Classification,Phase Development Life Cycle,Software Development Process Models.

UNIT-II

Software Project Management: Project Management Essentials, What Is Project Management,Project Life Cycle, Risk Management, Project Planning Estimation,Projects Planning Activities, Software Metrics And Measurement, Project Size Estimation,Staffing And Personnel Planning, Project Scheduling And Milestones.

Requirements Engineering: Software Requirements,Requirements Engineering Process,Requirement Elicitation, Requirement Analysis, Structured Analysis, Data Oriented Analysis, Object Oriented Analysis,Requirements Specification,Requirements Validation.

UNIT-III

Software Design: Software Design Process, Characteristics Of A Good Software Design,Design Principles,Modular Design,Software Architecture, Design Methodologies.

Object Oriented Design Using UML: Object Oriented And Analysis And Design,Object Oriented And Concepts,Unified Modeling Language (Uml), Object Relationships,Uml Building Blocks, Uml Diagrams.

UNIT-IV

Implementation: Coding Principles,Coding Styles,Coding Process,Code Verification,Code Documentation,Software Testing, Testing Fundamentals,Test Planning,Blackbox Testing,White Box Testing, Levels Of Testing, Usability Testing, Regression Testing,Smoke Testing,Debugging Approaches.

Software Quality And Reliability: Software Quality Concept,Software Quality Factors,Verification And Validation,The Cost Of Quality,Software Quality Assurance,Quality Control, The ISO Quality Standard,The Capability Maturity Model,Six Sigma,Software Reliability, Reliability Growth Model.

UNIT-V

Software Maintenance: Software Change,Software Evolution,Software Maintenance,Maintenance Process Models,Maintenance Cost,What Is Reengineering,Reengineering Activities.

Suggested Reading:

1. UgrasenSuman "**Software Engineering concepts and Practices**", Cengage Learning,2013

Reference Books:

1. Roger S. Pressman, "**Software Engineering – A Practitioners Approach**", 7 th Edition, Pearson Education, India, 2010.
2. Shari LawrencePfleeger, "**Software Engineering Theory and Practices**" 4th Edition - Pearson Education, India, 2011.

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Course Code: 16CSE241

ADHOCANDSENSOR NETWORKS

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The main objectives of this course are:

1. To impart knowledge about Adhoc networks, design and implementation issues and available solutions.
2. To impart knowledge of routing mechanisms and the approaches in Adhoc networks.
3. To provide knowledge of sensor networks and their characteristics.
4. To study the applications of sensor networks.

Course Outcomes:

After completion of the course, studentswill be able to:

1. Describe the unique issues in adhoc/sensor networks.
2. Understand current technological trends for the implementation and deployment of wireless adhoc/sensor networks.
3. Explain the challenges in designing MAC, routing and transport protocols for wireless adhoc sensor networks.
4. Gain knowledge on implementation of protocols on a sensor test bed network.
5. Explain the principles of mobile adhoc networks (MANETs)
6. Explain the principles and characteristics of wireless sensor networks (WSNs).

UNIT-I

Introduction to Adhoc networks, Wireless LANs, Wireless PANs, Wireless Mesh Networks, Topology Control in Wireless Adhoc Networks, Broadcasting and Activity Scheduling in Adhoc Networks, Location Discovery, Mobile Adhoc Networks (MANETs): Routing Technology for Dynamic Wireless Networking, Congestion Control in adhoc wireless networks.

UNIT-II

Introduction, Routing in Adhoc Networks, Broadcasting, Multicasting and Geocasting, Mobile Adhoc Networking with a View of 4G Wireless: Imperatives and Challenges, Off-the-Shelf Enables of Adhoc Networks, IEEE 802.11 in Adhoc Networks: Protocols, Performance and Open Issues.

UNIT-III

Media Access Control (MAC) Protocols: Issues in designing MAC protocols, Classifications of MAC protocols, MAC protocols, Cognitive Radio and Networks, TCP over Adhoc Networks, Energy-Efficient Communication in Adhoc Wireless Networks, Adhoc Networks Security, Self-Organized and Cooperative Adhoc Networking, Security in Adhoc and Sensor Networks.

UNIT-IV

Introduction to Sensor networks, Introduction and Overview of Wireless Sensor Networks: Applications of Wireless Sensor Networks, Examples of Category 1 WSN Applications, Basic Wireless Sensor Technology: Sensor Node Technology, Sensor Taxonomy, WSN Operating Environment, WSN Trends.

UNIT-V

Sensor Networks Design Considerations, Sensor Networks in Controlled Environment, Wireless Transmission Technology and Systems: Radio Technology Primer, Available Wireless Technologies. Medium Access Control Protocols for Wireless Sensor Networks: Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC Case Study, IEEE 802.15.4 LR-WPANs Standard Case Study.

Integrating MANETs, WLANs and Cellular Networks, Networking Sensors: Unique features, Deployment of adhoc/sensor network, Sensor tasking and control, Transport layer and security protocols, Applications of Sensor Networks.

Suggested Reading:

1. C. Siva Ram Murthy & B. S. Manoj, "**Adhoc Wireless, Networks – Architecture and Protocols**", Prentice Hall, 2004.
2. JagannathanSarangapani, "**Wireless Adhoc and Sensor Networks: Protocols, Performance, and Control**", CRC Press, 2007.

Reference Books:

1. Carlos de MoraisCordeiro and Dharma PrakashAgrawal, "**Adhoc and Sensor Networks : Theory and Applications**", Second Edition, World Scientific Publishers, 2011
2. PrasantMohapatra and Sriramamurty, "**Adhoc Networks: Technologies and Protocols**", Springer International Edition, 2009
3. KazemSohraby, Daniel Minoli, TaiebZnati, "**Wireless Sensor Networks"**, A John Wiley & Sons Inc. Publication, 2007

Course Code: 16CSE242

EMBEDDED SYSTEMS

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:
The man objectives of this course are:
1. To study the principles and concepts of embedded systems architecture embedded development and design approaches.
2. To discuss about the operating systems of embedded systems and their characteristics.
3. To identify and discuss about the tools for embedded system development.
4. To study about the process of embedded product development.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the basics concepts related to embedded systems and challenges in embedded systems
2. Describe the architecture of embedded systems
3. Understand the embedded hardware design and development using embedded EDA tools
4. Write programs for embedded systems.
5. Identify the characteristics of embedded operating systems and analyze the performance of embedded systems
6. Understand the process of embedded product development

UNIT-I
Introduction to Embedded Systems: Characteristics and quality attributes of Embedded Systems, Challenges in Embedded System Design, Application and Domain specific Embedded Systems.

UNIT–II
Embedded System Architecture: Instruction Set Architecture. CISC and RISC instruction set architecture. Basic Embedded Processor/Microcontroller Architecture, CISE Examples Motorola (68HCI 1), RISC Example- ARM. DSP Processors. Harvard Architecture Microcontroller Example - PIC.

UNIT –III
Embedded Hardware Design and Development: VLSI and Integrated Circuit Design. EDA tools. usage of ED A tools and PCB layout.
Embedded firmware and Design and Development: Embedded Hardware Design Approaches and Development languages and Programming in Embedded in C.

UNIT -IV
Operating System for Embedded Systems: Real Time Operating Systems Based Embedded System Design, Introduction to Embedded, Systems Design with Micro C/OS- II and Vx Works.
Performance Issues of an Embedded System: CPU Performance, Analysis and Optimization of CPU Power Consumption, Program. Execution Time. Energy and Power. Program Size.

UNIT-V

Embedded Systems Development Environment: IDE. Cross Compilation, Disassembler,Simulators, Emulators and Debugging. Target Hardware Debugging. Boundary Scan. Product Enclosure Design and Development Tools, Embedded Product Development Life Cycle- Different phases and Approaches of EDLC. Trends in Embedded Industry.

Suggested Reading:

1. Shibu K V "**Introduction to Embedded Systems**" . Tata McGraw HilI,201O.
2. Raj Kamal, "**Embedded Systems Architecture; Programming & Design** ", Tata McGraw Hill.2010.

Reference Books:

1. Dr K.V.K.K. Prasad, "**Embedded Real time Systems: Concepts, Design and Programming**", Dreamtech Press, 2004.

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Course Code: 16CSE243

IMAGE PROCESSING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The main 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.
4. To study various image compression techniques.

Course Outcomes:

At the end of the course, students will be able to

1. Understand the fundamentals of digital image processing.
2. Gain knowledge about image transformation techniques used in Image processing
3. Understand various image enhancement techniques used in digital image processing.
4. Describe various image segmentation methods used in digital image processing.
5. Explain various compression techniques their application.
6. Describe the image restoration models.

UNIT-I

Image Formation and Description: Digital Image Representation - Elements of Visual Perception.Sampling & Quantization. Elements of Digital Image Processing Systems.

UNIT-II

Image Transforms: Digital Image Transforms - Fourier Transform, Extension to 2D, DCI. Walsh, Hadamard Transforms.

UNIT-III

Image Enhancements and Segmentation : Histogram Modification. Image Smoothing - Image Smoothing - Image Sharpening, Thresholding. Edge Detection. Segmentation. Point and Region Dependent Techniques.

UNIT-IV

Image Encoding: Fidelity Criteria. Transform Compression. K- Fourier, DCT, Spatial Compression. Run length Coding. Huffman Coding, Contour Coding.

UNIT-V

Restoration: Restoration Models, Inverse Filtering, Least Squares Filtering, Recursive Filtering.

Suggested Reading:

1. Gonzalez R.D.. Woods R.E. "**Digita1 Image Processing**", Addison Wesley, 1992.
2. Rosenfeld A, Kak AC. "**Digita1 Picture Processing**", Vol. I & II Acad. Press. 2nd ed. 1982.

Reference Books:

1. Milan Sonka. Vaclav Hlavac, Roger Boyle, “**Image Processing and Analysis and Machine Vision**", 2nd Edition, Thomson Learning, 1999.

Course Code: 16CSE251

CLOUD COMPUTING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The objectives of cloud computing 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:

Upon successful completion of the course, student should 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 and explore virtualization techniques that serve in offering software, computation and storage services on the cloud.
3. Apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost.
4. Illustrate the concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and HDFS.
5. Understand the security and privacy issues related to cloud computing environments.
6. Analyze various cloud programming models and apply them to solve problems on the cloud.

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 for Data-Center Automation.

Case studies: XenVMM, VMware, Microsoft Virtual Server

UNIT-III

Cloud platform architecture over Virtualized Data Centers: Data-Center design and Interconnection networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platform, 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 layersand Homomorphic Encryption, Format Preserving Encryption.
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, Mobile Internet Devices and the Cloud

Suggested Reading:

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. RajkumarBuyya, James Broberg and Andrzej M. Goscinski,"**Cloud Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing)"**, Wiley Publishing©2011.

Web resources:

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

Reference Books:

1. Raluca Ada Popa, Catherine M.S. Redfield, NickolaiZeldovich, and HariBalakrishnan, "**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.

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Course Code: 16CSE252

SOFT COMPUTING

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:
At the end of the course, student should
1. Identify and describe soft computing and their roles in building intelligent machines
2. Recognize the feasibility of applying a soft computing methodology for a particular problem
3. Develop a Neural network for the proposed model
4. Design a genetic algorithm and implement various genetic operators
5. Ability to incorporate Fuzzy Logic and developing Neuro-fuzzy systems.

Course Outcomes:
Upon successful completion of the course, should be able to
1. Evaluate and compare solutions by various soft computing approaches for give problem
2. Develop the skills to design and implement Genetic algorithm solutions to various problems
3. Applying Fuzzy Logic and the techniques of Neuro-fuzzy models.
4. Effectively use existing tools to solve real problems using a soft computing approach
5. Analyze various neural network architectures and apply the suitable model to solve engineering problems
6. Apply the genetic algorithms to combinatorial optimization problems

UNIT-I
Introduction to Soft Computing and Neural Networks: Evolution of Computing, Soft Computing Constituents, From Conventional AI to Computational Intelligence, Machine Learning Basics.

UNIT - II
Genetic Algorithms**:** Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning, Machine, Learning Approach to Knowledge Acquisition.

UNIT- III
Neural Networks: Machine Learning Using Neural Network. Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks, Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

UNIT- IV
Fuzzy Logic**:** Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT - V
Neuro-Fuzzy Modeling: Adaptive Neuro, Fuzzy Inference Systems, Coactive Neuro, Fuzzy Modeling, Classification and Regression Trees, Data Clustering Algorithms, Rule base Structure Identification, Neuro, Fuzzy Control, Case studies.

Suggested Reading:

1. Iyh, Shlng Roger Jang, Chuen,Tsai Sun, EijiMizutani, "**Neuro, Fuzzy and Soft Computing**", Prentice, Hall of India, 2003.
2. George J. Klir and Bo Yuan, "**Fuzzy Sets and Fuzzy Logic, Theory and Applications** ", Prentice Hall 1995.

Reference Books:

1. James A. Freeman and David M. Skapura, "**Neural Networks Algorithms, Applications, and Programming Techniques**", Pearson Edn., 2003.
2. Mitchell Melanie, "**An Introduction to Genetic Algorithm** ", Prentice Hall, 1998.
3. David E. Goldberg, "**Genetic Algorithms in Search. Optimization and Machine Learning**", Addison Wesley, 1997.

Course Code: 16CSE253

HIGH PERFORMANCE SYSTEMS

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

The objectives of high performance systems are:

1. To introduce students to high performance computing systems in science and engineering
2. Expose students to the features of modern processors that affects performance and be able to use these features in the design and optimization of high-performance software.
3. To utilize techniques to automatically implement, optimize, and adapt programs to different platforms.
4. To provide the concepts of parallel processing and develop the skills required to implement high-performance software
5. Learn techniques for analyzing the performance of programs and their interaction with the underlying hardware.

Course Outcomes:

Upon successful completion of the course the student will

1. Acquire knowledge to develop and execute parallel programs on high performance computing resources using parallel programming paradigms such as MPI
2. Have an understanding of the various high performance computing and their potential for performance and programmability.
3. Identify high performance computing paradigms like cluster, grid, heterogeneous and cloud computing
4. Be capable of developing algorithms that yield good performance on high performance architectures and be able to estimate and evaluate their performance.
5. Analyze a given problem for possibilities of parallel computations
6. Have an awareness of modern field of computational science and engineering and of the impact of high performance computing on industry

UNIT-1

Modern Processors: Stored-program computer architecture, General-purpose cache-based microprocessor architecture, Memory hierarchies, Multicore processors, multithreaded processors, Vector processors.

Basic Optimization Techniques for Serial Code: Scalar profiling, Common sense optimizations, Simple measures, large impact, the role of compilers C++ optimizations

Data Access Optimization: Balance analysis and light-speed estimates, Storage order (Case studies: The Jacobi algorithm and Dense matrix transpose), Algorithm classification and access optimizations (Case study: Sparse matrix-vector multiply)

UNIT-1I

Parallel Computers: Taxonomy of parallel computing paradigms, Shared-memory computers, Distributed-memory computers, Hierarchical (hybrid) systems Networks

Basics of Parallelization: Why parallelize? Parallelism, Parallel scalability

Shared-Memory Parallel Programming with OpenMP: Short introduction to OpenMP (Case study: OpenMP-parallel Jacobi algorithm),Advanced OpenMP: Wave front parallelization

Distributed-Memory Parallel Programming with MPI: Message Passing, A short introduction to MPI, Example: MPI parallelization of a Jacobi solver

Hybrid Parallelization with MPI and OpenMP: Basic MPI/OpenMP programming models, MPI taxonomy of thread interoperability ,Hybrid decomposition and mapping Potential benefits and drawbacks of hybrid programming

UNIT-1II

The brewing trends and transformations in the IT landscape: Introduction,The Emerging IT Trends, The Realization and Blossoming of Digitalized Entities**,** The Internet of Things (IoT)/Internet of Everything (IoE)**,**The Tremendous adoption of Social Media Sites**,** The Ensuring Era of Predictive, respective and Personalized Analytics**,** Apache Hadoop for Big Data and Analytics**,** Big Data into Big Insights and Actions**,** Conclusions.

The high performance Technologies: Introduction, The Emergence of Big Data Analytics(BDA) Discipline, The Strategic Implications of Big Data, The Big Data Analytics Challenges, The high-Performance Computing(HPC)Paradigms for fast and BDA,The High-Performance Approaches Through parallelism, Cluster computing, Grid computing, Cloud computing, Heterogeneous computing, Main Frames for High-performance Computing, Supercomputing for Big data Analytics, Appliances for Big Data Analytics

UNIT-IV

Network infrastructure for High –Performance: Introduction, Network Infrastructure for High performance Computing, Limitations of Present-Day Networks**,** Approaches for the Design of Network Infrastructure for High-Performance Big Data Analytics

Storage Infrastructure for High-Performance Big Data Analytics: Introduction,Storage Area Networks, Storage Infrastructure for storing big data, FC SAN, IP SAN, FCoE, NAS

UNIT-V

Real –Time Analytics Using High-Performance Computing: Introduction, Technologies That support Real-time Analytics, Processing in Memory(PIM), In-Database Analytics, MOA: Massive Online Analysis, General Parallel File System(GPFS)

High-performance Computing (HPC) Paradigms: Introduction, need of Mainframes, Cost-An Important Factor for HPC, Cloud Computing Centralized HPC, Requirements to Centralized HPC,HPC Remote Simulation

Suggested Reading:

1. **"Introduction to High Performance Computing for Scientists and Engineers**", Chapman & Hall/CRC Computational Science 2010 by Georg Hager, Gerhard Wellein
2. Pethuru Raj, Anupama Raman, DhivyaNagaraj, "**High-Performance Big Data Analysis: Computing Systems and Approches**", 1st ed. 2015, Springer.

Reference Books:

1. CUDA by Example,"**An Introduction to General-Purpose GPU Programming**"
2. Michael J Quinn, "**Parallel programming in C with MPI and OpenMP**", Tata McGraw Hill, 2003.
3. Kaihwang and NareshJotwani, "**Advanced Computer Architecture**" 2nd edition Tata McGraw-Hill References:

Course Code: 16CSE261

SOFTWARE REUSE TECHNIQUES

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:
At the end of the course student should able
1. To explain the benefits of software reuse.
2. To understand and several different ways to implement software reuse techniques.
3. To explain how reusable concepts can be represented as patterns.
4. To comprehend the nature of design patterns.
5. To provide a specific context for each pattern in which it is applied.

Course Outcomes:
Upon successful completion of the course
1. Students will be able to identify and describe the different approaches and techniques to the software reuse development.
2. Students will be able to determine and apply the knowledge acquired on software reuse techniques.
3. Students should be able to apply the design patterns in creating an object oriented design.
4. Students will be able to use design patterns for real world situations.
5. Students should able to list consequences of applying each pattern.
6. Student will understand the benefits of a pattern approach over program in a software application.

UNIT – I
Software reuse success factors, Reuse driven software engineering as business, object oriented software engineering, Applications and Component subsystems, Use case components, Object components.

UNIT – II
Design Patterns – Introduction. Creational Patterns – Factory, factory method, abstract factory, singleton, builder, prototype.

UNIT – III
Structural Patterns – Adapter, bridge, composite, decorator, façade, flyweight, proxy. Behavioral Patterns – Chain of responsibility, command, interpreter.

UNIT – IV
Behavioral Patterns – Interartor, mediator, memento, observer, state, strategy, template, visitor. Other design patterns – Whole – part, master – slave, view handler, forwarder – receiver, client dispatcher – server, publisher – subscriber.

UNIT – V
Architectural Patterns – Layers, pipes and filters, black board, broker, model-view controller, presentation – abstraction – control, micro kernel, reflection.

Suggested Reading:

1. IvarJacabson, Martin Griss, Patrick Johnson, "**Software Reuse: Architecture, Process and Organization for Business Success**", ACM Press 1997.
2. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides – "**Design Patterns**", Pearson Education, 1995.
3. Frank Buschmann etc., "**Pattern Oriented Software Architecture – Volume I**", Wiley 1996.
4. James W Cooper, "**Java Design Patterns, a tutorial**", Pearson Education, 2000.

Course Code: 16CSE262

STORAGE MANAGEMENT

Instruction	Sessional Marks	Examination – Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:

At the end of the course student should able

1. To understand Storage Area Networks characteristics and components
2. To become familiar with the SAN vendors and their products
3. To learn Fibre Channel protocols and how communications used in SAN components.
4. To become familiar with Cisco MDS 9000 Multilayer Directors and Fabric Switchethoroughly learn Cisco SAN-OS features.
5. To understand the use of all SAN-OS commands. Practice variations of SANOS features

Course Outcomes:

Upon successful completion of the course, student can

1. Able to identify key challenges in managing information and analyze different storage networking technologies.
2. Able to understand components and the implementation of NAS
3. Able to understand CAS architecture and types of archives and forms of virtualization
4. Understand Storage security and Management
5. Able to monitor the storage infrastructure and management activities.

UNIT-I

Introduction To Storage Technology: Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

UNIT-II

Storage Systems Architecture: Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment ,Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, Concept of RAID and its components, Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems High-level architecture and working of an intelligent storage system 67

UNIT-III

Introduction To Networked Storage: Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, understand the need for long-term archiving solutions and describe how CAS full fill the need, understand the appropriateness of the different networked storage options for different application environments

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UNIT-IV

Information Availability, Monitoring & Managing Datacenter:List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime - Differentiate between business continuity (BC) and disaster recovery (DR) ,RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures, Architecture of backup/recovery and the different backup/ recovery topologies, replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities. Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data center

UNIT-V

Securing Storage And Storage Virtualization: Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain, Virtualization technologies, block-level and file-level virtualization technologies and processes

Suggested Reading:

1. G.Somasundaram, AlokShrivastava, EMC Education Series, “**Information Storage and Management**”, Wiley, Publishing Inc., 2011.

Reference Books:

1. EMC Corporation,”**Information Storage and Management**”, Wiley, India.
2. Robert Spalding, “**Storage Networks: The Complete Reference**“, Tata McGraw Hill , Osborne, 2003.
3. Marc Farley, “**Building Storage Networks**”, Tata McGraw Hill ,Osborne, 2001.
4. Additional resource material on www.emc.com/resource-library/resource-library.esp

Course Code: 16CSE263

STREAMING TECHNOLOGY

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3L Periods per week	30	3 Hours	70	3

Course Objectives:
At the end of the course student should able

1. To understanding the need for stream computing
2. To comprehend the architecture of stream analytics
3. To build the data flow management pipelines for streams.
4. To processing streaming data
5. To explain delivering the results of streaming analytics

Course Outcomes:
After the completion of this course, the student will be able to

1. Differentiate between types of Streaming Data.
2. Understand the architecture of Stream Anlaytics
3. Demonstrate the Distributed Data flows
4. Apply concepts to Streaming Data
5. Apply different metrics to real world Problems

UNIT-I
INTRODUCTION TO STREAM COMPUTING
Streaming Data – Sources – Difference between Streaming Data and Static Data.Overview of Large Scale Stream Processing Engines – Issues in Stream Processing.

UNIT-II
STREAMING ANALYTICS ARCHITECTURE
Phases in Streaming Analytics Architecture - Vital Attributes - High Availability – Low Latency – Horizontal Scalability-Fault Tolerance - Service Configuration and Management - Apache ZooKeeper.

UNIT-III
DATA FLOW MANAGEMENT
Distributed Data Flows – At Least One Delivery – Apache Kafka – Apache Flume – Zero MQ - Messages, Events, Tasks& File Passing.

UNIT-IV
PROCESSING & STORING STREAMING DATA
Distributed Stream Data Processing: Co-ordination, Partition and Merges, Transactions.Duplication Detection using Bloom Filters - Apache Spark Streaming Examples Choosing a storage system – NoSQL Storage Systems.

UNIT-V
DELIVERING STREAMING METRICS
Visualizing Data – Mobile Streaming Apps –Times Counting and Summation - Stochastic Optimization – Delivering Time Series Data.

Professor and Head Department

Suggested Reading:

1. Byron Ellis, “**Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data**”, Wiley, 1st edition, 2014.
2. SherifSakr, “**Large Scale and Big Data: Processing and Management**”, CRC Press, 2014. 2014.

Reference Books:

1. Bill Franks, “**Taming The Big Data Tidal Wave Finding Opportunities In Huge Data Streams With Advanced Analytics**”, Wiley, 2012.
2. Jure Leskovec, AnandRajaraman, Jeffrey D. Ullman, “**Mining of Massive Datasets**”, Cambridge University Press, 2014.
3. Paul C Zikopoulos, Chris Eaton, Paul Zikopoulos, “**Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data**”, McGraw-Hil, 1st edition, 2011.

Course Code: 16CSC104

ADVANCED DATABASES LAB (LAB-1)

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3 Periods per week	50	3 Hours	--	2

Course Objectives:

At the end of the course should get:

1. To understand and apply the concepts of Object Oriented Databases.
2. To design and implement queries using XML Database.
3. To design and implement a complete problem solution using Relational Databases.
4. To Understand the basics of advanced topics such as Parallel Databases, Distributed Databases and Spatial Databases

Course Outcomes:

Upon Successful Completion of Course, Students will

1. Be familiar with a Object Oriented Databases and be able to develop application based on it.
2. Be familiar with the XML databases and be able to write queries related to it.
3. Be able to construct an Entity Relationship (ER) model from specifications and to transform them to relational model.
4. Be able to develop database application using Relational Databases.
5. Master the advanced concepts and appreciate the applications of database systems.
6. Master the basics of Parallel Databases, Distributed Databases and Spatial Databases.

PRACTICALS:

1. Develop a database application to demonstrate the representation of multi-valued attributes and the use of nested tables to represent complex objects. Write suitable queries to demonstrate their use.

2. Write an XML to display the book information, which includes the following:
   - Title of Book
   - Author Name
   - ISBN Number
   - Publisher Edition
   - Price

3. A. Write a DTD to validate XML File
   B. Display XML as follows
   i) The contents should be displayed in a table. The header of table should be in Grey color
   ii) The author Names column should be displayed in one color & capitalized & should be in bold
   iii) Use your own colors for remaining columns. Use XSL & CSS for above purpose.

4. Write a program that uses the SAX parser to extract all elements with a particular tag. The user should be able to provide a tag name, and your program should show all instances of that tag.

5. Write a program that uses the DOM parser to provide a searchable interface to the document. The user should be able to provide an element type and value, and your program should display the corresponding data

6. Design XML Schema for the given company database
   Department (deptName, deptNo, deptManagerSSN,
   deptManagerStartDate, deptLocation)
   Employee (empName, empSSN, empSex, empSalary, empBirthDate,empDeptNo,
   empSupervisorSSN, empAddress, empWorksOn)
   Project (projName, projNo, projLocation, projDeptNo, projWorker)

   a). Write XML file to store Department, Employee and Project details.
   b). Write the queries using Xquery and Xpath and execute it using XQuery Engine.

   (i)Retrieve the department name, manager name, and manager salary for every department.

   (ii)Retrieve the employee name, supervisor name and employee salary for each employee who works in the Research Department.

   (iii)Retrieve the project name, controlling department name, number of employees and total hours worked per week on the project for each project.

7. Experiments on SQL Commands,joins,constraints and functions.
8. Design and implement library management system in RDBMS
   a) Collect the essential requirements for library management system such as student details, book details, issue.
   b) Define the entity sets and the attributes for library management system
      i. **Student details** – stud name, studno,
      ii. **Book details** – bookno, title, author name, book type.
   c) Define the Relationship sets such as lender, borrower, issue.
   d) Represent the strong and weak entity sets
   e) Design E-R diagram for library management system

   Reduce the E-R schema of library management system into tables using generalization and aggregation.

9. Case studies on Parallel Databases, Distributed Database and Object Oriented Databases .

Suggested Reading:

1. "**Database System Concepts**",AviSilberschatz ,Henry F. Korth and S.Sudarshan.Sixth Edition.McGraw Hill.

Course Code: 16EG104

SOFT SKILLS LAB
(Activity-based)

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3 Periods per week	--	3 Hours	--	--

Course Objectives:
To help the students
1. Participate in group discussions and case studies with confidence and to make effective presentations. Also to learn the art of communication.
2. With- resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management, leadership, self-confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.
5. To be competent in verbal aptitude.

Course Outcomes:
The 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 mange 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. Correct and complete sentences, have a good vocabulary and comprehend passages confidently

PRACTICALS:

Exercise 1
Group Discussion & Case studies – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence. Elements of effective presentation – Structure of presentation – Presentation tools – Body language
Creating an effective PPT

Exercise 2
Interview Skills – Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets
Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

Exercise 3
Personality Development– Effective Time Management, assertiveness, decision making and problem solving, stress management, team building and leadership.

Exercise 4

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Corporate Culture – Grooming and etiquette, corporate communication etiquette.
Academic ethics and integrity

Exercise 5
Verbal Aptitude – Sentence correction, sentence completion, jumbled sentences and vocabulary.
Reading comprehension

Suggested Reading:

1. LeenaSen , "**Communication Skills**", Prentice-Hall of India, 2005
2. Dr. ShaliniVerma, "**Body Language- Your Success Mantra**", S Chand, 2006
3. Edgar Thorpe and Showick Thorpe , "**Objective English**", 2nd edition, Pearson Education, 2007
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, "**The ACE of Soft Skills**", New Delhi: Pearson, 2010
5. Gulati and Sarvesh, " **Corporate Soft Skills**", New Delhi: Rupa and Co. , 2006
6. Van Emden, Joan, and Lucinda Becker, "**Presentation Skills for Students**", New York: Palgrave Macmillan, 2004
7. "**A Modern Approach to Verbal & Non-Verbal Reasoning**" by R S Aggarwal
8. Covey and Stephen R, "**The Habits of Highly Effective People**", New York: Free Press, 1989

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Course Code: 16CSC105

SEMINAR-I

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3 Periods per week	50	3 Hours	--	2

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for systematic independent study of state of the art topics in broad area of his / her specialization.

Seminar topics can be chosen by the students with the advice from the faculty members. Students are to be exposed to following aspects of Seminar presentations.

Literature Survey
Organization of material
Preparation of PowerPoint presentation slides
Technical Writing

Each Student is required to
1. Submit one page of synopsis of the seminar talk two days before for display on notice board
2. Give 20 minutes of PowerPoint presentation followed by 10 minutes of discussion.
3. Submit a report on the seminar topic with a list of references and slides used within a week.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule should be discouraged.

The sessional marks will be awarded to the students by at least two faculty members on the basis of an oral and written presentation in addition to their involvement in the discussion.

SCHOLARLY WRITING

- Learn how to use the scientific method
- Discuss your topic with fellow students
- Find literature sources
- Develop scholarly writing skills
- Develop critical thinking skills
- Investigate professors that are potential guides
- Learn about engineering requirements
- Develop bibliographic organization and citation skills
- Prepare a report

Course Code: 16CSC204

BIG DATA ANALYTICS LAB (LAB-2)

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3 Periods per week	50	3 Hours	--	2

Course Objectives:
At the end of the course student should able

1. To provide the knowledge on how to apply the methods using R for big data analysis.
2. To explore the statistical methods that can be used for analysis.
3. To implement the exploring and analysis of big data on a real world problem.
4. To apply the classification and clustering techniques on big data.
5. To execute the Hadoop techniques on big data for analysis.
6. To grasp the Hadoop Ecosystem

Course Outcomes:
Upon completion of this course, Student will be able to:

1. Deploy a structured lifecycle approach to data science and big data analytics projects.
2. Reframe a business challenge as an analytics challenge.
3. Apply analytic techniques and tools to analyze big data.
4. Create statistical models, and identify insights that can lead to actionable results
5. Use tools such as R and RStudio, Hadoop, in-database analytics
6. Apply big data techniques for real world problems.

PRACTICALS:

1. Review of Basic Data Analytic Methods Using R
   - Using R to Look at Data
   - Introduction to R
   - Analyzing and Exploring the Data
   - Statistics for Model Building and Evaluation
2. Advanced Analytics - Theory and Methods
   - K-means Clustering
   - Association Rules
   - Linear Regression
   - Logistic Regression
   - Naive Bayesian Classifier
   - Decision Trees
   - Time Series Analysis
   - Text Analysis
3. Advanced Analytics - Technology and Tools
   - Analysis for Unstructured Data (MapReduce and Hadoop)
   - The Hadoop Ecosystem

Suggested Reading:

1. Tom white, "**Hadoop: The Definitive Guide**", 4th edition, O'Reilly Media Inc. ,April 2015
2. VigneshPrajapati, " **Big data Analytics with R and Hadoop**", Packt Publishing, Nov 2013.

Reference Books:

1. Luca Massaron, Alberto Boschetti, "**Python Data Science Essentials**", Packt Publications, April 2015
2. Robert I. Kabacoff, "**R in Action Data analysis and graphics with R**", Manning Publications, May 2015.

Web Resources:

1. www.bigdatascienceschool.com/store
2. www.iitr.ac.in/media/facspace/patelfee/16Bit/index.html
3. www.class.coursera.org/datasci-001/lecture
4. www.bigdatauniversity.com

Professor and Head Department

Course Code: 16CSC205

SEMINAR-II

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
3 Periods per week	50	3 Hours	--	2

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for systematic independent study of state of the art topics in broad area of his / her specialization.

Seminar topics can be chosen by the students with the advice from the faculty members. Students are to be exposed to following aspects of Seminar presentations.

- Literature Survey
- Organization of material
- Preparation of PowerPoint presentation slides
- Technical Writing

Each Student is required to

1. Submit one page of synopsis of the seminar talk two days before for display on notice board
2. Give 20 minutes of PowerPoint presentation followed by 10 minutes of discussion.
3. Submit a report on the seminar topic with a list of references and slides used within a week.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule should be discouraged.

The sessional marks will be awarded to the students by at least two faculty members on the basis of an oral and written presentation in addition to their involvement in the discussion.

SCHOLARLY WRITING

- Learn how to use the scientific method
- Discuss your topic with fellow students
- Find literature sources
- Develop scholarly writing skills
- Develop critical thinking skills
- Investigate professors that are potential guides
- Learn about engineering requirements
- Develop bibliographic organization and citation skills
- Prepare a report

Course Code: 16CSC206

MINI PROJECT

Instruction	Sessional Marks	Examination - Duration	End Exam	Credits
2 Periods per week	50	3 Hours	--	1

Student should carry out mini project in the area of interest/course studied, identifying a real time problem under the supervision of guide.

Mini Projects will be monitored during the semester through individualpresentations.

Every student should maintain a mini project dairy, wherein he/she needs to record the progress ofhis/her work and get it signed at least once in a week by the guide(s). If working outside andcollege campus, both the external and internal guides should sign the same.

Sessional marks should be based on the marks, awarded by a mini project monitoring committeeof faculty members as well as the marks given by the guide.

Common norms are established for final documentation of the mini project report, the students aredirected to download from the website regarding the guidelines for preparing the mini projectreport and the mini project report format.

The mini project report shall be evaluated for 50 Marks and credits 1 by the committee.

If the mini project work found inadequate in the end examination, the candidate should repeat themini project work with a new problem or improve the quality of work and report it again.

1. Power point presentation
2. Thesis/Report preparation
3. Viva-voce

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16 MT C01

ENGINEERING MATHEMATICS – I

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

Course Objectives:

1. To solve Linear System of Equations using Matrix Methods
2. To Know the Partial Derivatives and use them to interpret the way a function of two variable behaves
3. To analyse the Shape of the Graph of a given Curve
4. To Evaluate Double and Triple integrals of various functions and their significance
5. Formulate and solve the Differential Equations of First Order
6. To know the methods to solve real life problems.

Course outcomes: On the successful completion of this course student shall be able to

1. Solve system of linear equations and identify the Eigen values and Eigen vector in engineering problems
2. Expand and find extreme values of functions of two variables
3. Trace and interpret curve behavior in physical systems
4. Find the areas, volumes and surface of solids revolution
5. Use-differential equations to model engineering phenomena such as circuit theory, networks
6. An ability to solve the problems and interpret it in geometrical approach

UNIT- I

Linear Algebra: Review of Rank & Consistency, Eigen values, Eigen vectors- properties (without proofs). Cayley-Hamilton Theorem (statement only) inverse and powers of a Matrix by Cayley-Hamilton Theorem. Reduction of Quadratic form to Canonical form by linear transformation, rank, positive, negative, definite, semi-definite, index and signature

UNIT- II

Functions of several variables: Partial differentiations, Homogenous function, Euler's theorem, Implicit functions, Jacobins, Taylor"s series in one and two variables, Maxima and Minima for function of two variables with and without constraints

UNIT- III

Differential Calculus: Curvature and Radius of curvature centre of curvature, circle of curvature. Evolutes, involutes and Envelopes, Curve tracing-Cartesian, polar and parametric curves

UNIT- IV

Multiple Integrals: Double Integrals, Triple Integrals, Change of order of Integration, Applications of integration, rectification, areas, volumes and surfaces of solids of revolution in Cartesian coordinates, Centre of Gravity, PAPPUS theorem.

UNIT- V

First order differential equations and its application: Exact differential equations, Orthogonal trajectory's, Electrical circuits, Newtons law of cooling

Text Books:

1. Ervin Kreyszig "Advanced Engineering " 10 Edition, john wiley & sons -publishers
2. A R.K.Jain&S.R.K.Iyenger "Advanced Engineering Mathematics" , 3rd edition, Narosa Publications
3. AlenJaffery "Mathematics for Engineers and Scientists", 6th edition : CRC press, Taylor & Francis Group.(Elsevier),2013

Suggested Reading:

1. Kanti.B.Datta "Mathematical Methods of science and engineering", Aided with MATLAB, .Cengage Learning India Pvt. Ltd, Pratapgang ,New Delhi
2. B.S.Grewal "Higher Engineering Mathematics" , Khanna Publishers
3. William E.Boyce /Richard C.Dip "Elementary differential equations" , 9th Edition

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16PY C01

ENGINEERING PHYSICS

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives: The objective of the course is to make the student
1. Understand the general concepts of physics
2. Acquire knowledge of different kinds of waves and their behavior
3. Familiar with crystal physics and materials
4. To introduce the general concepts of physics

Course Outcomes: At the end of the course, the student will be able to
1. Describe the types of oscillations and analyze them
2. Demonstrate the wave nature of the light
3. Develop the concepts related to electromagnetic behavior
4. Identify the various crystal systems and defects
5. Explain the origin of magnetism and dielectric polarization and applications of these materials in the field of engineering & technology

UNIT – I Waves and Oscillations: Review of free oscillations - Superposition of two mutually perpendicular linear SHMs of same frequency and 1:2 ratio frequency – Lissajous figures – Damped vibrations – Differential equation and its solution – Logarithmic decrement - Relaxation time – Quality factor – Forced vibrations – Differential equation and its solution – Amplitude resonance- Torsional pendulum.
Ultrasonics: Production of ultrasonics by piezoelectric and magnetostriction methods – Detection of ultrasonics – Determination of ultrasonic velocity in liquids – Applications.

UNIT – II Interference: Division of amplitude – Interference in thin films (reflected light) – Newton's rings – & division of wavefront – Fresnel's biprism.
Diffraction: Distinction between Fresnel and Fraunhoffer diffraction – Diffraction at single slit – Diffraction grating (N Slits) – Resolving power of grating.

UNIT – III Polarization: Malus's law – Double refraction – Nicol's prism – Quarter & Half wave plates – Optical activity – Laurent's half shade polarimeter.
Electromagnetic Theory: Review of steady and varying fields – Conduction and displacement current – Maxwell's equations in differential and integral forms – Electromagnetic wave propagation in free space, dielectric and conducting media – Poynting theorem.

UNIT – IV Crystallography: Space lattice - Crystal systems and Bravais lattices – Crystal planes and directions (Miller indices) – Interplanar spacing – Bragg's law – Lattice constant of cubic crystals by powder diffraction method.
Crystal Imperfections: Classification of defects – Point defects – Concentration of Schottky and Frenkel defects – Line defects – Edge dislocation – Screw dislocation – Burger's vector.

UNIT – V Magnetic Materials: Classification of magnetic materials – Langevin theory of paramagnetism – Weiss molecular field theory – Domain theory – Hysteresis curve – Structure of ferrites (spinel & Inverse spinel) – Soft and hard magnetic materials.
Dielectric Materials: Dielectric polarization – Types of dielectric polarization: electronic, ionic, orientation and space-charge polarization (Qualitative) – Frequency and temperature dependence of dielectric polarization – Determination of dielectric constant (Schering bridge method) – Ferroelectricity – Barium titanate – Applications of ferroelectrics.

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 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", McGahill Education Publications, 2013
3. P.K. Palanisamy, Engineering Physics", Scitech Publications, 2012
4. V. Raghavan, "Materials Science and Engineering", Prentice Hall India Learning Private Ltd., 6th Revised edition, 2015

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16CY C02

APPLIED CHEMISTRY

Instruction	2L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	20 Marks
Credits	2

Course Objectives:

Applied chemistry is a fascinating area with the profound implications for engineers as well as biologists. Materials fabricated and used in our daily life are derived from chemicals, both natural and synthetic and their range of utility are growing day by day. It is imperative that engineers of different disciplines acquire sufficient knowledge of the materials and their characteristics for making proper selection of their end -use application.

The various units of the syllabus is so designed to fulfill the following objectives.

1. To impart technological aspects of modern chemistry and to lay foundation for the application of chemistry in engineering and technology disciplines
2. The student should be conversant with the
   i. Principles of water characterization and treatment of water for potable and industrial purposes.
   ii. Principles of polymer chemistry and engineering applications of polymers in domestic and engineering areas
3. Knowledge to prevent corrosion of machinery and metallic materials and water chemistry which require serious attention in view of increasing pollution, has been included in the syllabus.
4. Study of polymers is insisted as it gives better insight to industrial personnel by being exposed to wider aspects of polymer science.
5. Study of fuel cells is given importance as fuel cells are the alternate energy sources for generating electrical energy on spot and portable applications.
6. Newer materials lead to discovering of technologies in strategic areas like defense and space research. Recently modern materials synthesized find applications in industry and technology and in order to emphasize them, topics like composite materials, polymers, conducting polymers and nano materials have been incorporated in the curriculum.
7. To enable students to apply the knowledge acquired in improving the properties of engineering materials.
8. To give an insight into nano materials and composite materials aspect of modern chemistry.

Course Outcomes:

1. At the end of the course, the students will be familiar with the fundamentals of water technology; corrosion and its control; applications of polymers in domestic and engineering areas; nano materials and their applications.
2. The engineer who has the above background can effectively manage the materials in his designing applications and for discovering & improving the systems for various uses in industry, agriculture, health care, technology, telecommunications and electronics.
3. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.
4. Study of nano related materials helps to update the knowledge necessary to launch into the demands of the world.

UNIT –I

Water Chemistry: Hardness of water – Types, units of hardness, Disadvantages of hard water - Boiler troubles - scales & sludge formation - causes and effects, softening of water by ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water, disinfection of water by chlorination, Ozonization, UV radiation.

UNIT -II

Corrosion Science : Introduction, chemical corrosion – oxidation corrosion , electro chemical corrosion and its mechanism , Galvanic corrosion and types of differential aeration corrosion (waterline corrosion) , Factors affecting corrosion (position of the metals in galvanic series, relative areas of anode and cathode, nature of corrosion product – solubility and volatility of corrosion product, nature of corroding environment – temperature, humidity and P^H. Corrosion control methods – cathodic protection, sacrificial anodic protection

UNIT – III

High Polymers: Definition of polymer, degree of polymerization. Thermo plastics and thermo sets. Preparation, properties and uses of plastics (Polyvinyl chloride, Bakelite), fibers (Kevlar, polyurethane), Rubbers – natural rubber and its chemical structure, vulcanization and its significance. Preparation, properties and uses of silicone rubber, conducting polymers – definition, classification and applications

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UNIT – IV

Battery Technology: Types of batteries - Primary batteries - Dry cell, Lithium battery; Secondary batteries - lead acid storage cell , Lithium ion battery ; Fuel cell - H_2-O_2 fuel cell, methanol-oxygen fuel cell – its advantages and applications
Solar cells – photo voltaic cells

UNIT–V

Engineering Materials: Nano materials – Introduction to nano materials and general applications, basic chemical methods of preparation – Sol-gel method. Carbon nanotubes and their applications
Composite materials – definition, types of composites, fibre reinforced, glass fibre reinforced and carbon fibre reinforced composites and applications.

Text Books:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Pub, Co., New Delhi (2002)
2. Applied Chemistry "A text for Engineering & Technology" Springer (2005).
3. ShasiChawla, "Text Book of Engineering Chemistry", Dhanpat Rai Publishing Company, NewDelhi (2008).
4. S.S. Dara "A text book of engineering chemistry" S.Chand & Co.Ltd., New Delhi (2006).
5. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
6. Applied Chemistry by N. Krishnamurthy:P. Vallinavagam. And K. Jeysubramanian TMH
7. Chemistry of Engineering Materials by CV Agarwal,C.P Murthy, A.Naidu, BS Publications.
8. Chemistry of Engineering Meterials by R.P Mani and K.N.Mishra, CENGAGE learning

Suggested Reading:

1. B.K.Sharma, "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001)
2. Water Treatment : F. I. Bilane, Mir publisher
3. Fundamentals of Corrosion: Michael Henthorne, Chemical Engineering.
4. A textbook of Polymer Science: Fred, Billmeyer Jr., Wiley India Third edition.
5. Chemistry of Advanced Materials: CNR Rao, Rsc Publication.
6. Materials Science and Engineering an Introduction, William D. Callister, (Jr. Wiley publisher).
7. Introduction to nano materials by T.Pradeep.

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16EE C 01

ELEMENTS OF ELECTRICAL ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. To understand the basic concepts of electrical circuits.
2. To understand the principles of electromagnetic induction.
3. To know about different types of batteries, charging and discharging of batteries and types of fuel cells etc.
4. To know about different types of electrical wires and cables, domestic and industrial wiring.
5. To understand safety rules and methods of earthing.

Course Outcomes: After completion of the course, the student will be able to:
1. Acquire the knowledge of basic concepts of electrical circuits such as Ohm's law, Kirchhorff's laws etc.
2. Acquire the knowledge of basic Faraday's laws of electromagnetic induction.
3. Acquire the knowledge to solve the problem of AC circuits.
4. Acquire the knowledge of specifications of batteries, types of cells and sources of renewable energy.
5. Acquire the knowledge of electrical wiring and cables and their types and electrical equipment and their specification.
6. Acquire the knowledge of safety precautions in handling electrical appliances, importance of grounding and methods of earthing.

UNIT-I DC Circuits
Current, voltage, power and energy, sources of electrical energy, independent and dependent sources, source conversion, circuit elements, Resistor, Inductor, Capacitor Ohm's law, Kirchhoff's laws, analysis of series, parallel and series-parallel circuits, star-delta conversion, Node and Mesh analysis (with independent sources only).

UNIT-II : Electromagnetism & AC Circuits Electric charge, electric field, lines of force, electric field intensity, electric flux and flux density, Faraday's laws of electromagnetic induction, static and dynamically induced EMF.
A.C. Circuits: Generation of alternating voltage and current, equation of alternating voltage and current, average and rms values of sinusoidal quantities, form and peak factors, phasor representation of sinusoidal quantities, AC through pure resistance pure Inductance, pure capacitance, RL,RC,RLC circuits.

UNIT-III: Batteries and Fuel Cell
Introduction to batteries, simple cell, EMF and internal resistance of a cell, primary and secondary cells, cell capacity, types and specifications of batteries, charging and discharging of battery, safe disposal of batteries; fuel cell, principle and types of fuel cell, different sources of renewable energy.

UNIT-IV: Electrical Wiring
Types of wires and cables, types of connectors and switches, system of wiring, domestic and industrial wiring, simple control circuit in domestic installation, electrical equipment and their specifications

UNIT-V: **Safety & Protection**
Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, other electrics hazards, safety rules, importance of grounding and earthing of electrical equipment, methods of earthing, circuit protection devices: Fuses, MCB, ELCB and Relays.

Text Books:
1. Edward Hughes, "Electrical and Electronics Technology", 10th Edition, Peasson Publishers 2010.
2. V.K. Mehta & Rohit Mehta, "Principles of Electrical Engineering", S.Chand Company Limited 2008
3. B.L. Theraja & A.K. Theraja, "Electrical Technology", Vol.I, S.Chand Company Limited 2008.

Suggested Reading:
1. P.V.Prasad & S. Siva Nagraju, "Electrical Engineering: Concepts & Applications", Cengage Learning, 2012.
2. S. Rao, "Electrical Safety, fire safety engineering & Safety Management", Khanna publications, 1998.
3. Surjit singh & Ravi Deep Singh, "Electrical Estimating and Costing", Dhanapath Rai & Co., 1997.

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16CE C01

ENGINEERING MECHANICS

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives: During this course, students should develop the ability to:

1. Work comfortably with basic engineering mechanics concepts required for analyzing static structures
2. Identify an appropriate structural system to study a given problem and isolate it from its environment.
3. Analyze and model the problem using free-body diagrams and equilibrium equations
4. Apply pertinent principles to the system to solve and analyze the problems subjected to frictional forces.
5. Understand the meaning of centroid/ centers of gravity and moments of Inertia using integration methods.
6. Communicate the solution to all problems in an organized and coherent manner and elucidate the meaning of the solution in the context of the problem.

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

1. Solve problems dealing with forces in planar force systems
2. Draw free body diagrams to analyze the forces in the given structure
3. Understand the concept of moments and couples in plane systems.
4. Understand the mechanism of friction and can solve friction problems
5. Determine the centroid of plane areas and centers of gravity of bodies using integration methods
6. Determine moments of inertia, product of inertia for all areas and mass moments of inertia for bodies,

Unit - I

Force Systems: Resolution of coplanar and non-coplanar force systems (both concurrent and non-concurrent), Determining the resultant of planar force systems. Moment of force and its applications and couples

Unit – II

Equilibrium of force system: Free body diagrams, equations of equilibrium of planar force systems and its applications. Problems on general case of force systems

Unit – III

Theory of friction: Introduction, types of friction, laws of friction, application of friction to a single body & connecting systems. Wedge and belt friction

Unit – IV

Centroid: Significance of centroid, moment of area, centroid of line elements, plane areas, composite areas, theorems of Pappus & its applications. Center of gravity for elementary and composite bodies

Unit – V

Moment of Inertia: Definition of MI, Polar Moment of Inertia, radius of gyration, transfer theorem, moment of Inertia of elementary & composite areas, product of inertia. Mass moments of inertia for elementary and composite bodies

Text Books:

1. K. Vijay Kumar Reddy and J. Suresh Kumar, Singer's Engineering Mechanics, BS Publications, Hyderabad, 2011.
2. Ferdinand L Singer, Engineering Mechanics, Harper and Collins, Singapore, 1904.

Suggested Reading:

1. A. Nelson, Engineering Mechanics, Tata McGraw Hill, New Delhi, 2010.
2. S. Rajashekaran & G. Sankarasubramanyam, Engineering Mechanics, Vikas publications, Hyderabad, 2002.
3. S.B. Junarkar and H.J Shah, Applied Mechanics, Charotar publishers, New Delhi, 2001.
4. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press, New Delhi, 2008.
5. A K Tayal, Engineering Mechanics, Umesh Publications, New Delhi, 2010

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16EG C01

PROFESSIONAL COMMUNICATION IN ENGLISH

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To enable the students to understand the role and importance of communication and to develop their basic communication skills in English.
2. To strengthen the students' usage of grammar and to develop their vocabulary.
3. To improve the students' listening skills and introduce them to different reading strategies.
4. To equip the students with appropriate writing skills.
5. To enhance imaginative and critical thinking through literary texts and book review.

Course Outcomes: The students will

1. Understand the nature, process and types of communication and will communicate effectively without barriers.
2. Understand the nuances of listening and will learn to make notes
3. Read different texts, comprehend and draw inferences and conclusions.
4. Write effective paragraphs, letters and reports
5. Critically analyze texts and write book reviews

UNIT- I Understanding Communication in English: Introduction, nature and importance of communication. Process of communication. Basic types of communication - verbal and non verbal. One way vs. Two way communication. Barriers to communication. Intrapersonal and interpersonal communication. Johari Window.
Grammar & Vocabulary: Parts of speech, figures of speech – Euphemism, Hyperbole, Irony, Metaphor, Onomatopoeia, Oxymoron, Paradox, Personification, Pun & Simile

UNIT- II Developing Listening Skills: Exposure to recorded and structured talks, class room lectures- problems in comprehension and retention. Types of listening, barriers to listening, effective listening strategies. Note –taking.
Grammar & Vocabulary: Articles, Prepositions, Phrasal verbs, Idioms.

UNIT- III Developing Writing Skills: Sentence structure. Brevity and clarity in writing. Cohesion and coherence. Paragraph writing. Letter writing - form and structure, style and tone. Kinds of Letters –Apology and request letters. Email etiquette. Report writing.
Grammar & Vocabulary: Tense, Conditionals, homonyms, homophones.

UNIT - IV Developing Reading Skills: The reading process, purpose, different kinds of texts. Reading comprehension. Techniques of comprehension – skimming, scanning, drawing inferences and conclusions. Note-making
Grammar &Vocabulary: Concord, Connectives, Active and Passive voice, Words often confused.

UNIT- V: Reading for Enrichment

1.	The Road Not Taken	Robert Frost
2.	Goodbye Party For Miss Pushpa T. S	Nissim Ezekiel
3.	The Open Window	Saki
4.	The Romance Of A Busy Broker	O. Henry

Book reviews -Oral and written review of a chosen / novel/ play - a brief written analysis including summary and appreciation. Oral presentation of the novel/play
Grammar & Vocabulary: Indianisms, Common errors, Parallelisms.

Text Books:

1. Vibrant English, Orient Blackswan Ltd,

Suggested Reading:

1. M .Ashraf Rizvi, Effective Technical Communication, Tata Mc Graw- Hill, New Delhi
2. Meenakshi Raman and Sangeetha Sharma, Technical Communication - Principles and Practice, Oxford Univ. Press, New Delhi.
3. Sunil Solomon, English for Success, Oxford University Press, 2015
4. Krishna Mohan, Meera Banerji, Developing Communication Skills, McMillan India Ltd.
5. Michael McCarthy, English Vocabulary in Use.
6. Brikram K Das, Kalyani Samantray, An Introduction to Professional English and Soft Skills Cambridge University Press, New Delhi.

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16CE C02

ENVIRONMENTAL STUDIES

Instruction	1L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	- - -
Credits	1

Course Objectives:
1. To equip the students with inputs on the environment, natural resources and their conservation.
2. To study the interrelationship between the living organisms and the natural environment and also to enable the students to understand the structure and functioning of the ecosystems.
3. To understand the importance of biodiversity and create awareness on its threats and conservation strategies.
4. To enable the students become aware of pollution of various environmental segments including their causes, effects and control measures.
5. To create awareness about environmental legislations in the context of national conventions.

Course Outcomes: At the end of the course, the student should have learnt
1. To understand the scope and importance of environmental studies, identify the natural resources and ecosystems and contribute for their conservation.
2. To understand the ecological services of biodiversity and contribute for their conservation.
3. To develop skills to solve the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
4. To relate the social issues and the environment and contribute for the sustainable development.
5. To understand the essence of the ethical values of the environment for conserving depletable resources and pollution control.

UNIT – I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Water resources- hydrological cycle, use and over utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Food resources- Changes caused by modern agriculture, fertilizers-pesticide problems, water logging and salinity. Forest resources- use and over exploitation, deforestation. Mineral resources- Use and exploitation, effects of mining. Energy resources- Growing energy needs, various renewable and non-renewable energy sources. Land resources- land as a resource, land degradation- causes and effects, Role of individuals in conservation of natural resources.

UNIT – II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, concept of food chains, food webs, ecological pyramids.

UNIT – III

Biodiversity: Types/classification of biodiversity, India as a mega diversity nation, values of biodiversity, threats to biodiversity, Conservation of biodiversity.

UNIT – IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, Soil pollution, Noise pollution and Thermal pollution.

Environmental Legislations: Environment protection act, Air, Water, Forest & Wild life acts.

UNIT – V

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development, Population explosion and Climate change: Global warming, Acid rain, Ozone layer depletion.

Text Books:

1. P. D.Sharma, “Ecology & Environment”, Ashish publications, 1994
2. Y. Anjaneyulu, “Introduction to Environmental Science”, B S Publications, 2004

Suggested Reading:

1. Dr. Suresh K. Dhameja, “Environmental Studies”, S. K. Kataria & Sons, 2009
2. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley, 1991
3. S. S. Dara, “A Text Book of Enviromental Chemistry & Polution Control”, S. Chand Limited, 2006

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16ME C02

ENGINEERING GRAPHICS

Instruction	1L + 3D Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. To provide an exposure in understanding the drawings during a multidisciplinary approach towards a problem
2. To train up in perception and imagination of a three dimensional scenario.

Course Outcomes:
1. To understand theory of projections
2. Ability to improve visualization skills
3. Ability to sketch Engineering Objects

UNIT – I
Introduction to Engineering Drawing: Drawing Instruments and their uses, types of lines, use of pencils, Lettering, Rules of dimensioning
Conic Sections: Ellipse, Parabola, Hyperbola including the Rectangular Hyperbola (General method only)
Cycloidal curves: Construction of cycloid, epi-cycloid, hypo-cycloid & involutes

UNIT – II
Orthographic Projections: Principles of Orthographic Projections – Conventions , Projection of Points, Projection of Lines - inclined to both planes.

UNIT – III
Projections of Planes: Projections of regular Planes – Perpendicular planes and Oblique planes.

UNIT – IV
Projections of Solids: Projections of Regular Solids – Regular Polyhedra, solids of revolution, (Simple position only)
Sections of Solids: Types of cutting planes – their representation – sections of solids in simple position.

UNIT – V
Introduction to Graphic packages: Getting started, Basic drawing and editing commands, creating lines, planes and solids.

Note: Syllabus for external examination will be from unit 1 to unit 4 only & unit-5 is exempted from external examination. Unit 5 is for internal examination only.

Text Books:

1. N.D.Bhatt,” Elementary Engineering Drawing”, Charotar Publishers, 2012
2. Basanth Agrawal and C M Agrawal “Engineering Drawing 2e “, McGraw-Hill Education(India) Pvt. Ltd.

Suggested Reading:

1. K.L.Narayana and P.K.Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011
2. P.S.Gill’ “Engineering Graphics”, Kataria Publications, 2011
3. K.Veenugopal, “Engineering Drawing and Graphics + Autocad”, New Age International Pvt. Ltd, 2011
4. Shaw M.B and Rana B.C., “Engineering drawing”, Pearson, 2nd edition, 2009
5. P I Varghees, “ Engineering Graphics “,Tata McGraw-Hill publications, 2013
6. Bhattacharya. B, “Engineering Graphics”, I. K. International Pvt. Ltd, 2009
7. Dhawan R.K., “Principles of Engineering Graphics and Drawing”, S. Chand, 2011

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16PY C03

ENGINEERING PHYSICS LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

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

1. Apply theoretical physics knowledge in doing experiments
2. Understand the behavior of the light experimentally
3. Analyze the behavior of magnetic and dielectric materials

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

1. Understand the concept of errors and find the ways to minimize the errors
2. Demonstrate interference and diffraction phenomena experimentally
3. Distinguish between polarized and unpolarized light
4. Determine the loss of energy of a ferromagnetic material and its uses in electrical engineering
5. Understand the suitability of dielectric materials in engineering applications

List of 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 mercury light
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. B-H Curve – Determination of hysteresis loss of given specimen
9. Dielectric Constant – Determination of dielectric constant of given PZT sample
10. Ultrasonic Interferometer – Determination of velocity of ultrasonics in given liquid

Note: A student must perform a minimum of eight experiments.

Suggested Reading:

1. "Engineering Physics" - Manual by Department of Physics, CBIT, 2016
2. S.K. Gupta, "Engineering Physics Practical", Krishna's Educational Publishers, 2014
3. O.P. Singh, V. Kumar and R.P. Singh, "Engineering Physics Practical Manual", Ram Prasad & Sons Publications, 2009

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16CY C04

APPLIED CHEMISTRY LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives:

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory
2. For practical understanding of theoretical concept of chemistry.
3. The student should be conversant with the principles water characterization and treatment of potable and industrial purposes.

Course Outcomes:

1. This syllabus helps the student to understand importance of analytical instrumentation for different chemical analysis.
2. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.

LIST OF EXPERIMENTS

1. Introduction to chemical analysis
2. Preparation of standard solution of oxalic acid and Standardization of NaOH
3. Estimation of amount of oxalic acid in the given solution using Mohr's salt and $KMnO_4$
4. Estimation of total hardness of water using EDTA solution
5. Estimation of temporary hardness and permanent hardness of water using EDTA solution
6. Estimation of amount of carbonate in the given solution using HCl link solution
7. Estimation of amount of carbonate and bicarbonate in the given solution using HCl link solution
8. Estimation of amount of HCl conductometerically using NaOH solution
9. Estimation of amount of CH_3COOH conductometerically using NaOH solution
10. Estimation of amount of HCl and CH_3COOH present in the mixture of acids conductometerically using NaOH solution
11. Estimation of amount of HCl potentiometrically using NaOH solution
12. Estimation of amount of Fe^{+2} potentiometrically using $KMnO_4$ solution

Suggested Reading:

1. Applied Chemistry: Theory and Practice (Latest ed.), By O.P. Vermani & A.K. Narula
2. Vogel's Textbook of Quantitative Chemical Analysis (Latest ed.), Revised by G.H. Jeffery, J. Bassett, J. Mendham & R.C. Denney
3. Instrumental methods of Chemical Analysis, MERITT & WILLARD East-West Press

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16EG C02

PROFESSIONAL COMMUNICATION LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives:

1. To introduce students to phonetics and the different sounds in English.
2. To familiarize the students with the software and give them sufficient practice in correct pronunciation.
3. To enable students to speak English correctly with focus on stress and intonation.
4. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
5. To understand team work, role behavior and to develop the ability to analyze, evaluate, construct and refute arguments.

Course Outcomes:

1. The students will understand the speech sounds in English and the nuances of pronunciation.
2. The students will understand tone, intonation and rhythm and apply stress correctly.
3. The students will be able to participate in group discussions with clarity and confidence.
4. The students will speak confidently on stage with appropriate body language.
5. The students will debate on various issues and learn to work in teams.

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. **Aspects of connected speech**: Strong forms, weak forms, contracted forms, elision.
4. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
5. **Rhythm & Intonation**: Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
6. **Listening skills** – practice with IELTS and TOEFL material
7. **Situational dialogues and role play**
8. **Public speaking** is to be shown by incorporating narrative examples and extracts from speeches.
9. **Group Discussions**– videos to be shown and practice sessions
10. **Poster making** – preparation and presentation
11. **Debate -** Differences between a debate and a group discussion. Essentials of a debate, conducting a debate.

Suggested Reading:

1. E Suresh kumar et al, . English for Success (with CD), Cambridge University Press India Pvt Ltd. 2010.
2. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016
3. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
4. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
5. Edgar Thorpe. Winning at Interviews, Pearson Education, 2006
6. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd 2011

16 MT C02

ENGINEERING MATHEMATICS – II

Instruction	3L Periods per week + 1 (extra hour)
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To know the relevant methods to solve higher order differential equations.
2. To learn the Laplace and Inverse Laplace transforms for solving engineering problems.
3. To know improper integrals such as Beta, Gamma functions.
4. To learn Vector Differential Operator and its physical interpretations.
5. To evaluate vector line, surface & volume integrals.
6. Learn to apply all the above mathematical methods/techniques to interpret the results in physical and technical terms.

Course Outcomes:

1. Solve the solutions of Differential Equations which arise in electrical circuits, vibrations and other linear systems.
2. Able to solve solutions of differential equations with initial and boundary value problems.
3. Evaluating definite integrals using Beta, Gamma functions.
4. Understating the significance of gradient, divergent and Curl.
5. Use Greens, Gauss and Stoke's theorems to find the surface and volume integrals.
6. Able to solve and analyse the Engineering problems.

UNIT-I Ordinary differential Equations: Linear Differential equations of higher order with constant coefficients, complementary function and particular integrals when RHS is of the forms $e^{ax}, \sin ax, \cos ax, x^m, e^{ax}(v), x^m(v)$,where v-is a function of x, Cauchy's equation, electrical circuits of second order

UNIT-II Laplace Transforms: Laplace transforms of standard functions, Laplace transforms of piecewise continuous functions, first shifting theorem, multiplication by 't', division by 't'. Laplace transforms of derivatives and integrals of functions-Unit step function- Periodic functions (without proofs). Inverse Laplace transforms-by partial fractions (Heaviside method), Convolution Theorem, Solving Ordinary differential equations by Laplace Transforms

UNIT-III Beta and Gamma Functions: Definitions of Beta and Gamma functions-elementary Properties of both Beta and Gamma functions, Relation between Beta and gamma functions, differentiation under the integral sign.

UNIT-IV Vector Differentiation: Scalar and vector fields- directional derivative- Gradient of a scalar-Divergence and Curl of a vector point function. Properties of divergence, curl, Solenoidal and Irrotational vectors

UNIT-V Vector Integration: Evaluation of Vector Line integrals, surface integrals and volume integrals, Greens, Gauss divergence and Stokes theorems (without proofs) and its applications

Text Books:

1. Erwin Kreyszig "Advanced Engineering Mathematics,"10th edition, John Wiley & Sons -Publishers.
2. R.K.Jain & S.R.K.Iyenger "Advanced Engineering Mathematics" , 3rd edition, Narosa Publications
3. Alen Jaffery "Mathematics for Engineers & Scientists" , 6th ed 2013 CRC press, Taylor & Francis Group. (Elsevier)
4. Dr.B.S.Grewal "Higher Engineering Mathematics", 43rd edition, Khanna Publishers.

Suggested Reading: (for further reading and examples on applications)

1. A.Craft and Robert Davison "Mathematics for Engineers-a modern interactive approach" -Willey
2. Loius Pipes "Applied Mathematics and physicists" Mc Graw Hill publishers.
3. Kanti.B.Datta "Mathematical Methods of Science & Engg," Aided with MATLAB,. Cengage Learning India Pvt.Ltd.
4. AR Collar and A. Simpson "Matrices for Engineering Dynamics" -John Willey & sons.

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16CY C01

ENGINEERING CHEMISTRY

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

The syllabus has sought to fulfil the objective of making the student of engineering and technology realize that chemistry is the real base of his profession and that therefore he must have a good understanding of chemistry before he can use it in his profession.

" the study of chemistry is profitable not only in as much as it promotes the material interest of mankind ,but also because it furnishes us with insight into the wonders of creation , which immediately surround us and with which our existence, life and development, are most closely connected." ----- Justus Von Leibig (German Chemist)

The various units of the syllabus is so designed to fulfil the following objectives.

1. This syllabus helps at providing the necessary introduction of the chemical principles involved and devices in a comprehensive manner understandable to the students aspiring to become practicing engineers.
2. The aim of framing the syllabus is to impart intensive and extensive knowledge of the subject so that students can understand the role of chemistry in the field of engineering.
3. Thermodynamics and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. Fuels have been taught with a view to give awareness as to materials which can be used as sources of energy
5. To understand importance of analytical instrumentation for different chemical analysis.

Course Outcomes:

1. This syllabus gives necessary theoretical aspects required for understanding intricacies of the subject and also gives sufficient exposure to the chemistry aspects in different disciplines of engineering
2. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.
3. This syllabus imparts a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

UNIT – I

Chemical Thermodynamics: Introduction and definition of the terms, the concept of reversible and irreversible processes, Work done in isothermal and adiabatic processes, Success and limitations of First law of thermodynamics, need for second law of thermodynamics, statements of second law of thermodynamics, Carnot cycle, heat engine and its efficiency, Carnot theorem, concept of Entropy - Entropy changes in reversible and irreversible processes, physical significance of entropy criteria of spontaneity in terms of entropy and Gibb's free energy function , Gibb's-Helmholtz equation and applications, Numericals.

UNIT – II

Phase rule & Chemical Equilibria

Phase rule : Statement , definition of the terms - phases, components , degrees of freedom with examples, Phase diagram - one component system (water system), two component system (siver-lead system) , desilverisation of lead.

Chemical Equilibria - Homogenous and Heterogenous Equilibria - applications

UNIT – III

Fuels: Classification, requirements of a good fuel, calorific value, types of calorific value, calculation of CV using Dulong's formula, Combustion - calculation of air quantities by weight and volume, Numericals.

Solid fuels: coal - analysis of coal – proximate and ultimate analysis - importance.

Liquid fuels - crude oil - fractional distillation, cracking - Fixed bed catalytic cracking, knocking, antiknocking agents (TEL, MTBE), octane number, cetane number, unleaded petrol.

Gaseous fuels - LPG, CNG - composition and uses

UNIT – IV

Electrochemistry Introduction, construction of electrochemical cell, sign convention, cell notation, cell emf, SOP and SRP, electrochemical series and its applications, Nernst equation and applications, Types of Electrodes - Standard Hydrogen Electrode, Saturated Calomel Electrode, Quinhydrone electrode and Ion selective electrode (Glass electrode), construction, Numericals

UNIT –V

Instrumental Techniques in Chemical Analysis: Principle, method and applications of Conductometry (acid-base titration), Potentiometry (acid-base, redox titration), pH- metry (acid – base titration), Colorimetry (Beer Lambert's law)

Green Chemistry - outlines and Principles

Text Books:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Pub, Co., New Delhi (2002)
2. Puri & Sharma, "Principles of Physical Chemistry
3. S.S.Dara & S.S.Umare, "Engineering Chemistry", S.Chand company
4. J.C. Kuriacase & J. Rajaram, "Chemistry in engineering and Technology", Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
5. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
6. P.R.Vijayasarathi, "Engineering Chemistry" PHI Learning Private Limited, New Delhi (2011)

Suggested Reading:

1. Physical chemistry by P.W.Atkin (ELBS OXFORD PRESS)
2. Physical chemistry by W.J.Moore (Orient Longman)
3. Physical Chemistry by Glasstone
4. Physical Chemistry by T.Engel & Philip Reid, Pearson Publication.
5. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd.,Meerut (2001).

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16PY C02

APPLIED PHYSICS

Instruction	2L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	20 Marks
Credits	2

Course Objectives: The objectives of the course is to make the student
1. Learn the concepts of modern physics
2. Gain knowledge of wave mechanics and statistical mechanics
3. Know the different kinds of materials and their characterization techniques

Course Outcomes: At the end of the course, the student will be able to
1. Understand the advances in laser physics, holography, optical fibers and apply them in engineering & technology
2. Explain the importance of wave mechanics and band theory of solids
3. Analyze and apply distributions of statistical mechanics for problem solving
4. Identify the materials with semiconducting and superconducting properties for engineering applications
5. Understand the role of novel materials and their characterization techniques in engineering and technology

UNIT – I Lasers & Holography: Characteristics of lasers – Spontaneous & stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – He-Ne laser – Semiconductor laser – Applications. Basic principle of Holography – Recording & Reconstruction of hologram – Applications
Optical Fibers: Principle and Construction – Propagation of light through an optical fibre – Acceptance angle – Numerical aperture – Pulse dispersion – Classification of optical fibers: Single mode & Multi mode and Step-index & Graded-index optical fibers – Double crucible method – Applications.

UNIT – II Wave Mechanics: Schrödinger time independent and time dependent wave equations – Physical significance of wave function – Infinite square well potential (particle in a box) – Potential barrier – Tunneling effect .
Band Theory of Solids: Origin of energy band formation – Electron in periodic potential – Kronig-Penny model (qualitative) – Classification of solids

UNIT – III Elements of Statistical Mechanics: Maxwell-Boltzmann statistics – Bose-Einstein statistics – Fermi-Dirac statistics – Photon gas – Planck's' law of black body radiation – Wien's law and Rayleigh-Jean's law from Planck's law – Concept of electron gas (qualitative) – Fermi energy level.

UNIT – IV Semiconductors: Intrinsic and extrinsic semiconductors – Carrier concentration in intrinsic semiconductors – Energy gap – Hall Effect – Construction & working of solar cell.
Superconductors: General properties of superconductors – Meissner's effect – Type I and Type II superconductors – BCS theory (qualitative) – Applications.

UNIT – V Nanomaterials: Properties of materials at reduced size – Surface to volume ratio – Quantum confinement –Preparation of nanomaterials: Bottom-up approach (Sol-gel method) & Top-down approach (Ball milling method) – Elementary ideas of carbon nanotubes – Applications of nanomaterials.
Techniques for Characterization of Materials: X-ray fluorescence – Auger (OJ) process – Scanning electron microscope (SEM) – Tunneling electron microscope (TEM) – Atomic force microscope (AFM).

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 Engineering Physics", S. Chand Publications, 2014.
3. Satya Prakash, "Statistical Mechanics", Kedar Nath Ram Nath Publications, 2008.
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. M. Arumugam, "Materials Science", Anuradha Publications, 2015.
3. P.K. Palanisamy, "Engineering Physics", Scitech Publications, 2012.
4. Hitendra K Malik and A.K. Singh, "Engineering Physics", Tata McGraw Hill Education Publications, 2011

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16CS C01

PROGRAMMING AND PROBLEM SOLVING

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

Course Objectives:
1. To acquire problem solving Skills.
2. To be able to write Algorithms.
3. To understand structured programming Approach.
4. To understand Memory structure.
5. To implement I/O Programming.
6. To be able to write program in C Language.

Course Outcomes: Student will be able to:
1. Develop algorithms for scientific problems.
2. Explore algorithmic approaches to problem solving.
3. Understand the components of computing systems.
4. Choose data types and structure to solve mathematical problem.
5. Develop modular programs using control structure, arrays and structures.
6. Write programs to solve real world problems using structured features.

UNIT – I
Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts.
Introduction to C Language: Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

UNIT – II
Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do-While and Examples. Continue, Break and goto statements.
Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Parameter Passing-Call-by-value, call-by-reference, Recursion**.**

UNIT – III
Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.
Arrays: Concepts, Using Arrays in C, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays.
Searching and Sorting: Linear and Binary Search, Selection Sort and Bubble Sort.

UNIT – IV
Pointers: Introduction, Pointers to Pointers, Compatibility, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command-line Arguments.
Strings: Concepts, String Input /Output Functions, Arrays of Strings, String Manipulation Functions.

UNIT – V
Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Unions, Type Definition (typedef), Enumerated Types.
Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/output Functions, Character Input/output Functions
Preprocessors: Preprocessor Commands

Text Books:

1. Pradip Dey and Manas Ghosh “Programming in C 2/e” Oxford University Press , 2nd Edition 2011.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language” Prentice Hall India, 2nd Edition. 1990.
3. B.A.Forouzan and R.F. Gilberg A Structured Programming Approach in C, Cengage Learning,2007.

Suggested Reading:

1. Rajaraman V. "The Fundamentals of Computers" 4th Edition, Prentice Hall of India, 2006.
2. R S Bichker “programming in c” University Press ,2012.

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16ME C01

ELEMENTS OF MECHANICAL ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. Student will understand different types of engineering materials and their applications.
2. Student will come to know working principles of Petrol & Diesel engines with basic knowledge of thermodynamics.
3. Student will understand various making processes.
4. Student will come to know various power transmission devices.
5. Student will understand the importance of principles of management in industry.
6. Student will come to know aspects of various quality control techniques.

Course Outcomes: At the end of the course, students will be able to
1. Select the material depending upon requirement.
2. Evaluate performance of Petrol & Diesel engines.
3. Demonstrate his/her knowledge in preparing process chart for various machining operations.
4. Estimate the power required for various power transmitting devices like belt and gear trains.
5. Become a successful entrepreneur after studying principles of management.
6. Apply various quality control techniques after studying principles of industrial engineering.

UNIT – I Engineering Materials: Metals and their alloys, Ductile and brittle materials, Ceramics, Polymers, Composite materials
Simple Stresses & Strains: Stress-strain diagram (for ductile and brittle materials), Poison's ratio, Young's Modulus, Rigidity modulus, Bulk modulus, Failure theories, factor of safety.

UNIT – II Thermodynamics: Zeroth, First, Second and Third laws of thermodynamics and corollaries
I.C. Engines: Working principle of Two stroke and Four stroke SI and CI engines, Calculations of efficiencies
Heat Transfer: Fourier law of conduction in single coordinates, Newton's law of conduction, Stephens & Boltzmann law of radiation

UNIT – III Basic Manufacturing Processes: Introduction to Welding, Brazing & Soldering, Principles of gas welding & arc welding processes, Casting, Principles of sand casting and die casting, Principles of Turning, Drilling, Milling, Grinding, Knurling, Tapping and Honing operations

UNIT – IV Kinematics: Definitions of kinematic link, pair, mechanism and machine
Gear Trains: Simple, Compound, Inverted and Epicyclic gear trains
Belt Drives: Open and crossed belt drives, length of belts, ratio of belt tensions for flat belt, condition for maximum power transmission for flat belt
Fluid Mechanics: Definition and basic properties of fluids, types of fluids and fluid flows, stream lines, streak lines, stream function and velocity potential

UNIT – V Industrial Engineering & Management: Introduction to scientific management, basics and importance of work study, steps in conducting work study, time study, standard time, organization and types of organization, Quality definition and its importance, introduction to quality control, types of inspection.

Text Books:
1. Jonathan Wickert and Kemper E. Lewis, An Introduction to Mechanical Engineering, 3rd Ed, Cengage learning, USA, 2013
2. Yunus A. Cengel, Heat Transfer: A Practical Approach, Mcgraw-Hill, 2nd edition, 2002
3. Mahesh M Rathore, Thermal Engineering, Tata Mc Grw Hill Eduation Pvt. Ltd., 2010

Suggested Reading:
1. R K Rajput, Thermal Engineering, Laxmi Publications, 2010
2. Michael Geoffrey Stevenson, Industrial Engineering, University of N.S.W., Division of Postgraduate Extension Studies, 1972
3. PN Rao, Manufacturing Technology, Volume-I, 3rd Edition, Tata McGraw-Hill, Education, 2009
4. Thomas Bevan, Theory of Machines, 3rd Edition, Pearson Education India, 1986
5. P. N. Modi, S. M. Seth, Hydraulics and Fluid Mechanics: Including Hydraulic Machines, Standard Book House, 2011

16EC C01

ELEMENTS OF ELECTRONICS AND COMMUNICATION ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. To understand the elementary concepts of electronic devices.
2. To study basics of Boolean algebra and working of digital circuits.
3. To understand basic operations of AM, FM, filters and multiplexing .
4. To enable the students to understand the working of commonly used communication systems.
5. To give an exposure to the selected applications.

Course Outcomes: The students will be able to
1. Familiar with the basic electronic devices and simple circuits
2. Work with Boolean algebra principles, build the simple combinational and sequential circuits
3. Appreciate the need for modulation, filtering and multiplexing
4. Understand the working principles of a few communication systems
5. Familiar to the selected applications

UNIT – I
Basics of Passive and Active Devices
Classification of passive and active devices and their symbols; current flow in a semiconductor; Operating principle of a diode, its application as a rectifier; Operating principle of a transistor (BJT and JFET), Principle and use of Zener diode, Photo diode and LED.

UNIT-II
Introduction to Digital Electronics
Number systems, Binary addition and subtraction, ASCII code, Boolean algebra (Theorems and properties), Logic gates, Combinational circuits such as Half adder, Full adder and Half subtractor, Introduction to sequential logic, Basic Flip flop, Evolution of ICs, block diagram description of Microprocessor and Microcontroller.

UNIT – III
Principles of Communication Engineering (Elementary treatment only)
Basic Communication system components; Concept of Modulation, Introduction to AM, FM and comparisons; Introduction to wired and wireless communication; Concepts of filtering, LPF, HPF, BPF and BSF; concept of multiplexing, TDM and FDM.

UNIT-IV
Overview of Communication Systems
Radio spectrum and applications, Modes of propagation;
Basic cellular network and concepts of a cell, frequency reuse, hand-off and cross-talk;
Basic Radar block diagram and applications; Introduction to communication satellite, Geostationary satellites and subsystems, Applications of satellites, GPS, DTH, Remote Sensing;

UNIT –V
Basic operating principles of selected applications:
Block diagram of CRO and application; Software Defined Radio (SDR)-Definition and it's block diagram; Smart phone-features; Introduction to Wireless sensor networks (Bluetooth and ZigBee), RFID-and its types, basic functions; Introduction to Modem.

Text Books:
1. "Electronic Principles" by Albert Malvino and David J Bates, 7th Edition, 2006
2. "Digital Priniciples and Applications", by Donald P Leach, Albert Paul Malvino, Gautham saha, Tata McGraw Hill,6th Edition,2009
3. "Electronic Communication Systems", by Kennedy and Davis, Tata Megra Hill Publications, 4th Edition, 2008

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16CE C03

PROFESSIONAL ETHICS AND HUMAN VALUES

Instruction	1L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	- - -
Credits	1

Course Objectives:

1. To develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. To enable the students, understand the values, the need for value adoption and prepare them meet the challenges
3. To enable the students, develop the potential to adopt values, develop a good character and personality and lead a happy life
4. To motivate the students, practice the values in life and contribute for the society around them and for the development of the institutions /organisation around they are in.
5. To make the students understand the professional ethics and their applications to engineering profession

Course Outcomes:

1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, convert everything into happiness and contribute for the happiness of others.
4. Students become potential sources for contributing to the development of the society around them and institutions/ organisations they work in.
5. Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

UNIT-I Concepts and Classification of Values –Need and challenges for value Adoption -Definition of Values – Concept of Values – Classification of Values – Hierarchy of Values – Types of Values – Interdependence of Values
Need for value education – Lack of education in values – Benefits of value education- Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges

UNIT – II: Personal Development and Values in Life
Personal Development: – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity - Integrating values in everyday life

UNIT – III: Practicing Values for the development of Society
Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atrocities – Working for the Sustainable development of the society
Principles of Integrity-Institutional Development - Vision for better India.

UNIT – IV: Basic Concepts of Professional Ethics
Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional Ethics, Ethical dilemmas, Science – Religion - Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities like Sri.M.Visweshwarayya, Dr.APJ Abdul Kalam and JRD Tata

UNIT-V: Ethics in Engineering Profession
Engineering Profession-Technology and Society- Ethical obligations of Engineering Professionals-Role and responsibility of Engineers - A few Case Studies on Risk management safety and Risk Management
Plagiarism-Self plagiarism- -Ethics Standards and Bench Marking

Text Books:

1. Subramanian R, “ Professional Ethics “ , Oxford University Press , 2013
2. Nagarajan R S, “ A Text Book on Human Values and Professional Ethics “ New Age Publications , 2007
3. Dinesh Babu S, “ Professional Ethics and Human Values “ , Laxmi Publications , 2007

Suggested Reading:

1. SantoshAjmera and Nanda Kishore Reddy , “Ethics , Integrity and Aptitude”,McGrawhill Education Private Limited, 2014
2. Govinda Rajan M, Natarajan S, Senthil Kumar V S,“Professional Ethics and Human Values”, Prentice Hall India, Private Limited,2012
3. Course Material for Post Graduate Diploma In “Value Education & Spirituality” Prepared by Annamalai University in Collaboration with Brahma Kumaris, 2010

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16CS C02

PROGRAMMING LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

1. Demonstration of control structures.
2. Demonstration of switch case (menu driven).
3. Demonstration of Parameter passing Methods.
4. Demonstration of Functions using Recursion.
5. Demonstration of arrays Operations on Matrix.
6. Implementation of bubble sort.
7. Implementation of selection sort.
8. Implementation of Linear and Binary Search.
9. Implementation of string manipulation operations with and without library function.
10. Demonstration using Pointers.
11. Demonstration of Array of Structures.
12. Sequential file operations.

Text Books:

1. Pradip Dey and Manas Ghosh "Programming in C 2/e" Oxford University Press , 2nd Edition 2011.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language" Prentice Hall India, 2nd Edition. 1990.

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16ME C03

MECHANICAL AND IT WORKSHOP

Instruction	3P Periods per week
Duration of End Examination	3 Hours
End Examination	50 Marks
Sessional	25 Marks
Credits	2

Mechanical Workshop

Trades for Practice 1. Fitting 2. Tin Smithy 3. Carpentry 4. House Wiring Exercises in Fitting

1. To make a perfect rectangular MS flat
2. To do parallel cuts using Hack saw
3. To drill a hole and tap it
4. To make male and female fitting using MS flats-Assembly1
5. To make male and female fitting using MS flats-Assembly2

Exercises in Tin smithy

1. To make a square tray from the given sheet metal.
2. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
3. To make a scoop.
4. To make a dust pan from the given sheet metal.
5. To make a pamphlet box.

Exercises in Carpentry

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

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

Demonstration of plumbing and welding trades

Note: ***A minimum of 12 exercises from the above need to be done***

Suggested Reading:

1. Workshop Technology -- Hazra chowdary

IT Workshop

List of Tasks:

Task 1: MS Word: Formatting text, inserting images, tables, equations and hyperlinks
Document Management: Page layout techniques and printing

Task 2: MS Excel: Functions and formulas and graph plotting

Task 3: MS Power point presentation: Guidelines for effective presentation, inserting objects, charts, hyperlinks and navigation between slides

Task 4: Essentials Search Engines & Net etiquette, Plagiarism, Open source tools and other utility tools

Suggested Reading:

1. Scott Mueller's Upgrading and Repairing PCs, 18/e, Scott. Mueller, QUE, Pearson, 2008.
2. The Complete Computer upgrade and repair book, 3/e, Cheryl A Schmidt, Dreamtech

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16PY C04

APPLIED PHYSICS LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

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

1. Acquire knowledge in experiments of modern physics
2. Understand the characteristics of various semiconductor devises
3. Work with lasers and optical fibers

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

1. Understand the various applications of semiconductor devices and their suitability in engineering
2. Demonstrate the working of lasers and optical fibers and their applications in the field of communication
3. Analyze the electrical properties of a given solid based on its energy band gap
4. Verify the resistance and thermoelectric power properties with temperature variation
5. Demonstrate the concept of electron and its charge experimentally

List of Experiments:

1. Planck's Constant – Determination of Planck's Constant using photo cell
2. Solar Cell – Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance
3. Hall Effect– Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen
4. P-N Junction Diode – Study of V-I characteristics and calculation of resistance of given diode in forward and reverse bias
5. Laser – Determination of wavelength of given semiconductor red laser
6. Fibre Optics – Determination of NA and power losses of given optical fibre
7. Energy Gap – Determination of energy gap of given semiconductor
8. Thermistor – Determination of temperature coefficient of resistance of given thermistor
9. *e/m* of Electron by Thomson's Method
10. Thermoelectric Power – Determination of thermoelectric power of given sample

Note: A student must perform a minimum of eight experiments.

Suggested Reading:

1. "Applied Physics"- Manual by Department of Physics, CBIT, 2016
2. S.K. Gupta, "Engineering Physics Practical", Krishna's Educational Publishers, 2014
3. O.P. Singh, V. Kumar and R.P. Singh, "Engineering Physics Practical Manual", Ram Prasad & Sons Publications, 2009

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16CY C03

ENGINEERING CHEMISTRY LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives:

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory
2. For practical understanding of theoretical concept of chemistry

Course Outcomes:

1. This syllabus helps the student to understand importance of analytical instrumentation for different chemical analysis.
2. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.

List of Experiments:

1. Introduction to chemical analysis.
2. Preparation of standard solution of oxalic acid and Standardization of NaOH
3. Estimation of amount of Fe^{+2} in the given solution using Mohr's salt and $KMnO_4$
4. Estimation of amount of Fe^{+2} in the given solution using Mohr's salt and $K_2Cr_2O_7$
5. Estimation of amount of copper in the given solution using hypo solution.
6. Estimation of amount of HCl pH metrically using NaOH solution
7. Estimation of amount of CH_3COOH pH metrically using NaOH solution
8. Determination of concentration of given KMnO4 solution Colorimetrically
9. Determination of concentration of given $K_2Cr_2O_7$ solution Colorimetrically
10. Distribution of acetic acid between n-butanol and water.
11. Distribution of benzoic acid between benzene and water
12. Preparation of urea – formaldehyde / phenol- formaldehyde resin.

Suggested Reading:

1. Vogel' S text book of quantitative chemical analysis by J. Mendham and Thomas,Person education Pvt.Ltd New Delhi ,6th ed. 2002
2. Laboratory Manual on Engineering Chemistry by Dr. Subdharani (Dhanpat Rai Publishing
3. A Textbook on experiment and calculation in engineering chemistry by S.S. Dara S.Chand
4. Instrumental methods of Chemical Analysis, MERITT & WILLARD East-West Press

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16MT C05

ENGINEERING MATHEMATICS-III

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

Course objectives:

1. To study the expansion of functions in various intervals.
2. To form P.D.E and to find its solution.
3. To solve Wave, Heat & Laplace equations.
4. To learn Differentiation and Integration of complex valued functions.
5. To evaluate Complex Integration.
6. To evaluate Real definite integrals.

Course outcomes:

After successful completion of this course, student will be able to

1. Expand functions in the given intervals.
2. Solve linear and non linear PDEs.
3. Solve one-dimension, two-dimension, Heat steady state equations and also one-dimension wave equation.
4. Solve problems on Analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Expand functions by using Taylor's and Laurent's series.
6. Solve Real and Complex integrals by using Cauchy Theorems.

UNIT – I

Fourier series: Definition of Periodic, Single valued, finite maxima and minima of functions. Euler's Formulae, Dirichlets Conditions for Fourier expansion, Functions having points of discontinuity, Change of interval, Expansion of odd and even functions, Half-range sine series and cosine series.

UNIT-II:

Partial differential equations: Formation of partial differential equations by eliminating the arbitrary constants or arbitrary functions, solutions of linear partial differential equation of first order by using Lagrange's Method, solution of Non-linear partial differential equations of first order by using standard types, Charpit's Method.

UNIT - III

Applications of Partial differential equations: Solution of partial differential equations by using method of separation of variables, solution of vibration of a stretched string (1D-Wave equation), one dimensional heat equation, Two dimensional heat equation under steady state conditions.

UNIT - IV

Theory of Complex variables: Analytic functions, Cauchy Riemann equations (Cartesian and polar forms), construction of Analytic functions by using Milne-Thomson's method. Harmonic function. Complex line integrals, Cauchy's theorem, Cauchy's Integral formula and its derivatives and problems related to the above theorems.

UNIT - V

Expansion of functions, Singularities & Residues: Taylor's and Laurent's series Expansions (Only statements). Zeros, types of singularities, Residues and Cauchy's Residue theorem, Evaluation of real integrals by Cauchy's residue theorem. Evaluation of improper real integrals of the type: $\int_{-\infty}^{\infty} f(x)dx$ Where f(x) has no poles on real axis and $\int_{0}^{2\pi} f(\sin\theta, \cos\theta)d\theta$.

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2015.
2. M.D. Raisinghania, "Advanced Differential equations", 7th edition, S Chand publishers, 2013.
3. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7th edition, McGraw Hill publishers, 2003.

Suggested Reading:

1. N P Bali and Manish Goyal, "A Text Book of Engineering Mathematics", 9th Edition, Laxmi publishers, 2016.
2. Alan Jeffrey, "Mathematics for Engineers and Scientists", 6th Edition, Chapman & Hall/CRC publishers, 2013.
3. A R Vasistha and R K Gupta, "Integral transforms", Krishna prakashan publishers, 2004.
4. R.K.Jain & S.R.K.Iyenger, "Advanced Engineering Mathematics", 3rd edition, Narosa Publications, 2007.

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16IT C01

DISCRETE STRUCTURES AND APPLICATIONS

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 mathematical concepts like sets, functions, logic and to apply them in solving logic oriented problems.
2. To solve problems using graphs to model relationships, analyse data, apply probability concepts and recursive functions.
3. Develop mathematical concepts and techniques that serve as a preparation for more advanced quantitative courses.

Course Outcomes:

After successful completion of this course, student will be able to
1. Symbolize the given sentence using predicate logic and verify the given predicate formula and validity of the argument using universal specification and generalization and equivalence rules.
2. Understand basics of counting, apply permutations and combinations to handle different types of objects.
3. Describe and use recursively-defined relationships to solve problems using generating functions.
4. Analyze semi group, monoidgroup and abelian group with suitable examples and appreciate group theory applications in computer arithmetic.
5. Model problems in Computer Science using graphs and trees.
6. Demonstrate different traversal methods for trees and graphs.

Prerequisites:
1. Elementary Algebra.
2. Introductory computer science course with C and C++.

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.

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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", Sixth 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", Second edition, Macmillan, 2005.
3. Joel. Mott.AbrahamKandel, T.P.Baker, "Discrete Mathematics for Computer Scientist &Mathematicans", Prentice Hail N.J.,
4. C.L. Liu, "Elements of Discrete mathematics", McGraw-Hill, Third Edition.
5. U.S. Gupta, "Discrete Mathematical Structures", Pears

16IT C02

DATA STRUCTURES AND ALGORITHMS

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 develop proficiency in the specification, representation of various linear and nonlinear data structures.
2. To discuss applications of data structures.
3. To familiarize with various pattern matching algorithms and hashing.
4. To develop a base for advanced computer science study.

Course Outcomes:

After successful completion of this course, student will be able to

1. Understand the basic data structures arrays and linked lists.
2. Analyse time complexity of both iterative and recursive functions.
3. Define ADT necessary for solving problems based on Stacks and Queues.
4. Develop solutions using binary trees, advanced search trees, tries and graphs.
5. Use hash functions and handle collisions.
6. Understand various kinds of sorting techniques and apply appropriate techniques for solving a given problem.

Prerequisites:

Programming and Problem Solving (16CSC01), Programming Laboratory (16CSC02).

UNIT- I

Arrays, Linked Lists, and Recursion: Using Arrays, Storing Game Entries in an Array, Sorting 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, Implementing a Generic 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, Queues, and Deques: Stacks, The Stack Abstract Data Type, The STL Stack, A C++ Stack Interface, A Simple Array-Based Stack

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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.

List and Iterator ADTs: Lists, Node-Based Operations and Iterators, The List Abstract Data Type, STL Lists, STL Containers and Iterators.

UNIT- III

Trees: General Trees, Tree Definitions and Properties, Tree Functions, A C++ Tree Interface, A Linked Structure for General Trees, Tree Traversal Algorithms, Depth and Height, Preorder Traversal, Postorder Traversal, 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.

Strings: Pattern Matching Algorithms, Brute Force, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Tries, Standard Tries, Compressed Tries, Suffix Tries.

Sorting: Merge-Sort , Divide-and-Conquer, Merging Arrays and Lists, The Running Time of Merge-Sort , Merge-Sort and Recurrence Equations, Quick-Sort, Randomized Quick-Sort, Studying Sorting through an Algorithmic Lens, A Lower Bound for Sorting, Linear-Time Sorting: Bucket-Sort and Radix-Sort, Comparing Sorting Algorithms.

UNIT- IV

Search Trees: Binary Search Trees, Searching, Update Operations, C++ Implementation of a Binary Search Tree, AVL Trees, Update Operations, Splay Trees, Splaying, When to Splay, Amortized Analysis of Splaying, Tree, Multi-Way Search Trees, Update Operations for (2,4) Tree, Red-Black Trees, Update Operations.

Heaps and Priority Queues: The Priority Queue Abstract Data Type, Keys, Priorities, and Total Order Relations, Comparators, The Priority Queue ADT, A C++ Priority Queue Interface, Sorting with a Priority Queue, 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, Bottom-Up Heap Construction.

UNIT- V

Hash Tables: Hash Tables, Bucket Arrays, Hash Functions, Hash Codes, Compression functions, Collision-Handling Schemes, Load Factors and Rehashing.

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Graph Algorithms: 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, Implementing Depth-First Search, Breadth-First Search, Directed Graphs, Traversing a Digraph, Transitive Closure, Directed Acyclic Graphs, Shortest Paths, Weighted Graphs, Dijkstra's Algorithm, 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. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", CareerMonk Publications, 2016.

Suggested Reading:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition Addison-Wesley, 2007.
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. NPTEL Videos: Introduction to data structures and algorithms - 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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16IT C03

OBJECT ORIENTED PROGRAMMING

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 introduce object-oriented concepts and how they are supported by C++.
2. To facilitate students with the skills required to solve problems using object oriented concepts.
3. To impart the knowledge required to develop user interfaces and application environments.

Course Outcomes:

After successful completion of this course, student will be able to

1. Understand the difference between object oriented programming and procedural oriented language in C++.
2. Understand and analyse the basic concepts of Object Oriented Programming.
3. Apply more advanced C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling, etc.
4. Design, write and test programs that make appropriate use of object-oriented facilities, common to many object-oriented languages such as classes, overloading and inheritance.
5. Implement, document, test and debug solutions in C++.
6. Analyze and implement features of object oriented programming to solve real world problems.

Prerequisites:

Programming and Problem Solving(16CSC01).

UNIT I:

Object-Oriented Paradigm- OOPS- A new Paradigm, Evolution of Programming Paradigms, Moving from C to C++ Data Types, Operators and Expressions, Control Flow, Strings Modular Programming with Functions- Function Components, Passing Data to Functions, Function Return Data Type, Parameter Passing, Return by Reference, Default

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Arguments, Inline Functions, Function Overloading, Function Templates, Functions with Variable Number of Arguments, Recursive Functions.

UNIT II:

Classes and Objects: Class Specification, Class Objects, Accessing Class Members, Member Functions, Outside Member Functions as Inline, Accessing Member Functions within the Class, Data Hiding, Access Boundary of Objects Revisited, Empty Class, Pointers within a Class, Passing Objects as Arguments, Returning Objects from Functions, Friend Function and Friend Classes, Constant Parameters and Member Functions, Structures and Classes, Static Data Members and Member Functions. **Object Initialization and Clean-up:** **Constructors—**Parameterised Constructors, Destructor, Order of Construction and Destruction, Constructors with Default Arguments, Nameless Objects, Dynamic Initialization Through Constructors, Constructors with Dynamic Operations, Copy Constructor, Constructor with Two Dimensional Arrays, Constant Objects and Constructor, Static Data Members with Constructors and Destructors.

Dynamic Objects: Pointers to Objects, Array of Objects, Array of Pointers to Objects, Pointers to Objects Members, this Pointer, Self – Referential Classes, Passing Objects Parameters.

UNIT III:

Operator Overloading: Overloadable Operators, Unary Operator Overloading, Operator keyword, Operator Return Values, Nameless Temporary Objects, Limitations of Increment/ Decrement Operators, Binary Operator Overloading, Arithmetic Operators, Concatenation of Strings, Comparison Operators, Assignment Operators, New and Delete Operators, Conversion Between Objects and Basic types and Objects of different classes, Subscript and Assignment Operator overloading, Overloading with Friend Functions.

Inheritance: Derived Class Declaration, Forms of Inheritance, Constructors and Destructors in derived classes, Constructor invocation and data member initialization, Overloaded Member Functions, Types of Inheritances, Abstract classes and virtual base classes.

Exception Handling: Error Handling, Exception handling model, Exception handling constructs, Lists of exceptions, catch all exceptions, exceptions in: Constructors, Destructors, Operator overloaded functions, Inheritance Tree, Class Templates.

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UNIT IV:

Virtual Functions: Need for virtual functions, Pointer to derived class objects, definition of virtual functions, Array of pointers to base class objects, Pure virtual functions, Abstract classes, Virtual destructors, Dynamic Binding.

Streams Computation with Console: Introduction, Predefined console streams, Hierarchy of console streams, unformatted and formatted i/o operations, manipulators, stream operators with user defined classes.

UNIT V:

Streams Computation with Files : Introduction, Hierarchy of File stream classes, opening and closing of files, file modes, file pointers and their manipulators, Sequential and Random access to a file, ASCII and Binary files, saving and retrieving of objects, fstream class, Random Access to a File, Error handling during file manipulation, Command line arguments.

Generic Programming with Templates: Function template, Overloaded function templates, Nesting of function calls, Multiple arguments function template, user defined template arguments, Class templates, Inheritance of class templates, class template with overloaded operators.

Text Books:

1. K.R.Venugopal, RajkumarBuyya, “Mastering C++”, 2/e, TMH, 2016.
2. Paul Deitel, Harvey Deitel, “How to Program C++”, 9th Edition, Pearson, 2013.

Suggested Reading:

1. Bjarne stronusstrup, “The C++ Programming Language”, 4/e, Pearson, 2013.
2. SouravSahay, “Object Oriented Programming with C++”, 2/e, Oxford University Press.

Web Resources:

1. https://www.tutorialspoint.com/cplusplus/.
2. https://www.programiz.com/cpp-programming.
3. https://www.class-central.com/tag/c++.

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16IT C04

DIGITAL ELECTRONICS AND LOGIC 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 familiarize students with the principles of digital Hardware.
2. To explain the operation and design of combinational and arithmetic logic circuits.
3. To facilitate with the skills required to use HDL tools.

Course Outcomes:

After successful completion of the course, students will be able to

1. Design complex logic circuits, do simplification, analysis and synthesis.
2. Simulate digital circuits/systems design using VHDL.
3. Understand the principles of different combinational and arithmetic logic designs and VHDL code.
4. Acquire knowledge about the design of Latches and Flip-flops and their Applications.
5. Understand the basic steps of Synchronous Sequential Circuits.
6. Gain knowledge about the behaviour, analysis and synthesis of Asynchronous Sequential Circuits.

Prerequisites:

Elements of Electronics and Communications Engineering (16ECC01),Applied Physics (16PYC02).

UNIT – I

Design Concepts – Digital Hardware, Design process, Design of digital hardware.Introduction to logic circuits – Variables and functions, Logic gates and networks. Boolean algebra, Synthesis using AND, OR, and NOT Gates, Design examples. Optimized implementation of logic functions – Karnaugh Map, Strategies for minimization, minimizing Product-of-Sum Forms, Incompletely Specified functions. NAND and NOR logic networks, Very High Speed Integrated Circuit Hardware Description Language (VHDL).

UNIT – II

Programmable logic devices: general structure of a Programmable Logic Array (PLA), gate level diagram, schematic diagram, Programmable Arrav

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Logic (PAL) Structure of CPLDs and FPGAs, 2-input and 3-input lookup tables (LUT). Design of Arithmetic-circuits, VHDL for Arithmetic-circuits, Combinational circuit building blocks – Multiplexers, Decoders, Encoders, Code converters, Arithmetic comparison circuits. VHDL for Combinational circuits.

UNIT – III

Basic Latch, Gated SR Latch, Gated D Latch, Master-Slave and Edge-Triggered D Flip-Flops, D Flip-Flops with Clear and Preset. T Flip-flop, JK Flip-flop, Excitation tables and timing diagrams Registers: Shift Register, Parallel-Access Shift Register, Counters: Asynchronous and Synchronous counters, BCD counter, Ring counter, Johnson counter.

UNIT – IV

Synchronous Sequential Circuits – Basic design steps.State-Assignment problem Moore and Mealy state model.State minimization, Finite State Machine (FSM) as an Arbiter Circuit. Algorithmic State Machine (ASM) charts, formal model.

UNIT – V

Asynchronous Sequential Circuits – Behaviour, Analysis, Synthesis, State reduction, State Assignment, examples. Hazards: static and dynamic hazards, Significance of Hazards.

Text Books:

1. Stephen Brown, ZvonkoVranesic, "Fundamentals of Digital Logic with VHDL design", 2nd Edition, McGraw Hill, 2009.
2. ZVI Kohavi, Switching and Finite Automata Theory, 2ndedition, Tata McGraw Hill, 1995.

Suggested Reading:

1. Jain R.P., "Modern Digital Electronics," 3rd edition, TMH, 2003.
2. John F. Wakerly, "Digital design Principles & Practices", 3rdedition, Prentice Hall, 2001.
3. M. Morris Mano, Charles R. Kime, "Logic and Computer Design Fundamentals", 2nd edition, Pearson Education Asia, 2001.
4. William I Fletcher, "An Engineering Approach to Digital Design", Eastern Economy Edition, PHI.
5. H.T. Nagle, "Introduction to Computer Logic", Prentice Hall, 1975.

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16IT C05

DATA STRUCTURES AND ALGORITHMS 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 introduce basic data structures and algorithms.
2. To introduce Non-linear data structures.
3. To familiarise students with graph operations and algorithms.
4. To familiarise students with advanced tree structures like AVL and Tries.

Course Outcomes:

After successful completion of this course, student will be able to

1. Implement various data structures using arrays, linked lists.
2. Develop ADT necessary for solving problems based on Stacks and Queues.
3. Implement binary trees, general tree structures, advanced search trees, heaps, graphs.
4. Implement tries.
5. Implement hash functions and handle collisions.
6. Implement various kinds of sorting techniques and apply appropriate techniques for solving a given problem.

Prerequisites:

Programming and Problem Solving (16CSC01), Programming Laboratory (16CSC02).

List of Programs

1. Define List ADT and implement its operations.
2. Implement Stack ADT and perform arithmetic expression evaluation.
3. Implement Queues, Circular Queues and Deques.
4. Define String ADT and implement Boyer Moore pattern matching algorithm.
5. Implement Tries.
6. Implement the following Sorting Techniques: Insertion Sort, Bubble Sort, Selection Sort, Shell Sort, Merge Sort, Quick Sort and Heap Sort.
7. Construct a Binary Search Tree and implement Tree Traversals.
8. Implement AVL Tree.
9. Implement Hashing with chaining.
10. Implement Graph Traversals.

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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", 3^{rd} Edition, CareerMonk Publications, 2016.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3^{rd} Edition Addison-Wesley, 2007.

Web Resources:

1. NPTEL Videos Introduction to data structures and algorithms - 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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16IT C06

OBJECT ORIENTED PROGRAMMING 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 familiarize students with object-oriented concepts and their implementation in C++.
2. To facilitate students with the skills required to solve problems using object oriented concepts.
3. To impart the knowledge required to write code with good coding practices.

Course Outcomes:

After successful completion of this course, student will be able to

1. Understand the process of writing, compiling and executing programs in C++ using appropriate predefined functions in C++.
2. Implement the object oriented concepts in developing application using C++.
3. Developing applications in C++ using the understanding of Inheritance andpolymorphism.
4. Understand and use exception handling while developing a C++ application.
5. Understand stream I/O, Files and usage of theavailable classes to handle stream objects in C++ language.
6. Develop complex applications by identifying the appropriate features of objectoriented programming to solve real world problems using C++.

List of Programs

1. To implement parameter passing techniques in functions.
2. To create a Class, Objects and illustrate Static members in a class.
3. To illustrate function overloading and inline function, Friend Functions.
4. To implement types of Constructor, Destructor and Array pointers.
5. To implement Method Overloading and Manipulation of strings.
6. To overload Unary Operator and Binary Operator.

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7. To Illustrate types of inheritance and Exception handling.
8. Illustrate virtual functions, Pointer to derived class objects, pure virtual functions, Abstract classes and virtual destructors.
9. To implement streams and perform operations on sequential access file and random access file.
10. Illustrate Function Template and Class Template.

Text Books:

1. K.R.Venugopal, Rajkumar Buyya, “Mastering C++”, 2/e, TMH, 2016.
2. Paul Deitel , Harvey Deitel, “How to Program C++”, 9/e, Pearson, 2013.

Suggested Reading:

1. Bjarne Strousstrup, “The C++ Programming Language”, 4/e, Pearson, 2013.
2. Sourav Sahay, “Object Oriented Programming with C++”, 2/e, Oxford University Press.

Web Resources:

1. https://www.tutorialspoint.com/cplusplus/.
2. https://www.programiz.com/cpp-programming.
3. https://www.class-central.com/tag/c++.

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16IT C07

MINI PROJECT – I

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, to take responsibility of the end product.
2. To develop capability to analyse and solve real world problems with an emphasis on applying/integrating knowledge acquired.

Course Outcomes:

After successful completion of this course, student will be able to

1. Construct innovative solutions.
2. To work in team as well as individuals.
3. To manage time and resources.

The Students are required to implement one of the projects from project exercise given in the suggested readings of the theory subjects. 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.

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16EG CO3

SOFT SKILLS AND EMPLOYABILITY ENHANCEMENT 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: To help the students

1. Participate in group discussions and case studies with confidence and to make effective presentations. Also to learn the art of communication.
2. With- resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management & goal setting, self-confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.
5. To understand the elements of research and hone their soft skills through a live, mini project.

Course Outcomes:

After successful completion of this course, student 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

Group Discussion and Case studies: Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Elements of effective presentation, Structure of presentation, Presentation tools, Body language, Creating an effective PPT.

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Exercise 2

Interview Skills: Resume writing, structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets.
Interview Skills: concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews.

Exercise 3

Personality Development: Effective Time Management, setting realistic goals, self-confidence and assertiveness, stress management, moral values.

Exercise 4

Corporate Culture: Grooming and etiquette, communication media etiquette, Academic ethics and integrity

Exercise 5

Mini Project: General/Technical Research, developing a questionnaire, data collection, analysis, written report and project seminar.

Suggested Reading:

1. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006.
2. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010.
3. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989.

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16IT C08

DESIGN AND ANALYSIS OF ALGORITHMS

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:

This course is introduced

1. To familiarize students with the concepts related to the design and analysis of algorithms.
2. To cover in detail greedy strategies, divide and conquer techniques, dynamic programming, back tracking and branch and bound for designing algorithms and illustrates them using a number of well-known problems and applications.
3. To describe two classes of problems NP hard and NP complete and discuss their applications.

Course outcomes:

After successful completion of the course, students will be able to

1. Determine the class and the algorithm technique most suited to solve the problem in hand.
2. Compare between different data structures. Pick an appropriate data structure for a design situation.
3. Design algorithms of their own for different problems.
4. Synthesize/adapt an algorithm to solve the problem in hand and argue its correctness.
5. Analyse best-, average- and worst-case complexities of algorithms using asymptotic notations.
6. Identify the complexity classes such as P, NP, NP-Complete and NP-Hard to which an algorithm belongs and design a feasible solution.

Prerequisites:

Programming and Problem Solving (16CSC01), Discrete Structures (16ITC01), Data Structures (16ITC02).

UNIT-I

Introduction: Algorithm Specification, Performance analysis, Space Complexity, TimeComplexity, Asymptotic Notation (O, Omega, Theta), Practical Complexities, PerformanceMeasurement, Randomized Algorithms: An informal discussion, Review of elementary datastructures : Stacks, Queues, Trees, Heap and Heap Sort, Set representation, UNION, FIND.

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UNIT-II

Divide- and Conquer: The general method, Finding the maximum minimum. Merge sort, Quick sort, Selection Problem, 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 graph, Single source shortest path, All Pair Shortest Path, Optimal Binary Search trees, 0/1 Knapsack, Reliability Design, Traveling Salesperson Problem, **Techniques for Graph Traversal**: Breadth First search and Traversal, Depth First Search and Traversal, Connected Components and Spanning Trees, Bi-connected Components .

UNIT-IV

Backtracking : The General Method, 8-Queens Problem, Graph Colouring, Hamilton cycle, Knapsack Problem, **Branch and Bounds:** The Method, LC Search, 15 puzzle, FIFO Branch and Bound, LC Branch and Bound, 0/1 Knapsack Problem, Traveling salesperson problem.

UNIT-V

NP-Hard and NP-Completeness: 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 and 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", Pearson Education, Second Edition, 2014.

16IT C09

DATA COMMUNICATIONS

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 is introduced to:

1. Familiarize students with the basics of data transmission, transmission media, data Communications System and its components.
2. Introduce various encoding, modulation schemes and data link protocols.
3. Give overview of different types of multiplexing and spread spectrum techniques.
4. Familiarize students with different types of Ethernet, architecture and services of WLANs and Bluetooth.

Course Outcomes:

After successful completion of this course, student will be able to

1. Demonstrate systematic understanding of Data Communication Techniques.
2. Apply various encoding schemes.
3. Understand multiplexing techniques.
4. Get acquainted with the concepts of virtual circuit networks.
5. Understand various types of switching techniques.
6. Understand concepts of wireless LANs.

Prerequisites:

Engineering physics(16PYC01), Applied physics(16PYC02).

UNIT-I

Data Communications, Data Networks and The Internet: Communications Model, Networks, The Internet, An Example Configuration, The Need for a Protocol Architecture, The TCP/IP Protocol Architecture, The OSI Model, Standardization within a Protocol.

Data Transmission: Concepts and Terminology, Analog and Digital Transmission, Transmission Impairments, Transmission media: Guided transmission media, wireless transmission.

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UNIT-II

Data Encoding: Digital Data Digital Signals, Digital Data-Analog Signals, Analog Data-Digital Signals, Analog Data-Analog Signals.

Digital data communication techniques: Asynchronous and Synchronous Transmission, Types of errors, error detection, error correction, Line Configuration.

Data Link Control protocols: Flow Control, Error Control, HDLC.

UNIT-III

Multiplexing: Frequency Division Multiplexing,Wavelength Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing.

Spread Spectrum: The Concept, Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum.

UNIT-IV

Circuit Switching and Packet Switching: Switched Communications Networks, Circuit-Switching Networks,Circuit-Switching Concepts, Soft switch Architecture,Packet-Switching Principles.

Virtual Circuit Networks: Frame Relay: Architecture, frame relay layers, extended address; ATM: Design goals, problems, architecture, switching, ATM layers.

UNIT-V

Traditional Ethernet: Topologies and Transmission Media, LAN protocol architecture, MAC sub layer, CSMA/CD, Physical Layer, Bridged, Switched and Full Duplex Ethernets Fast Ethernet: MAC sub Layer, Physical layer, Gigabit Ethernet: MAC sub Layer, Physical Layer.

Wireless LANs: Overview, Wireless LAN Technology, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control, IEEE 802.11 Physical Layer. Bluetooth: Architecture, Layers.

Text Books:

1. Behrouz A. Forouzan, “Data Communications and Networking”, 4th edition, TataMcGraw Hill, 2006.
2. William Stallings, “Data and Computer communication”, 8th edition, Pearson Education, Asia-2004.

Suggested Reading:

1. Fred Halsall, “Data Communications, Computer Networks and Open Systems”, 4th edition, Pearson Education, 2000.
2. Andrew S. Tanenbaum, “Computer Networks”, 5th edition, Pearson Education.
3. Gilbert Held, “Understanding Data Communications”, 7th Edition. Pearson Education.

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16IT C10

JAVA PROGRAMMING

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

Prerequisites:
Programming and problem solving (16CSC01), Object Oriented Programming (16ITC303)

Course Objectives:

1. To introduce the fundamentals of object-oriented programming in Java which includes defining classes, invoking methods, inheritance, polymorphism, exception handling etc.
2. To familiarize students with event driven Graphical User Interface (GUI) programming and usage of standard class libraries.
3. To impart skills required to solve real world problems by creating Java applications using sound OOP practices, and APIs.

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

1. Achieve proficiency in object-oriented concepts and also learns to incorporate the same into the Java programming language.
2. Create Java application programs using sound OOP practices e.g. Inheritance, interfaces and proper program structuring by using packages, access control specifiers.
3. Understand and Implement the concepts of Exception Handling in java.
4. Develop the ability to solve real-world problems through software development in high-level programming language using Large APIs of Java as well as the Java standard class library.
5. Understand File, Streams, Input and Output Handling in java.
6. Create graphical user interface and Applets in java as well as apply the knowledge of Event Handling.

UNIT-I

Introduction to Java: Objects, Classes, Java Programs, Introduction to jdk and jre, Java Primitive Types, Basic Operators, Conditional and Logical statements, Some Typical Differences Between C and Java. **Defining Classes:** Adding Instance Fields and Methods, Constructors, Access Modifiers (Visibility Modes), Object Creation Examples, Method Overloading and Constructor Overloading, Use of static and final

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keywords, Objects as parameters, Difference between local variable and instance field, Introduction to Object class, How to read user input from keyboard.

UNIT-II

Inheritance, Interfaces and Packages in Java: Defining super / sub classes, Abstract classes, Method overriding, Interfaces, Using Library Interfaces [Comparable &Comparator],**Packages:** Defining, Creating and Accessing a Package, Understanding CLASSPATH,importing packages, **Arrays, Strings in Java:** How to create and define arrays, Introduction to java.util.Array class, Difference between String &String Buffer 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 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:**What are Generics? Generic classes,bounded types, Generic methods and interfaces.

UNIT-IV

Collections: Overview of Java Collection Framework, Commonly used Collectionclasses – ArrayList, LinkedList, HashSet, TreeSet, HashMap, TreeMap, Collection Interfaces –Collection, Set, List, Map, Legacy Collection classes – Vector, Hashtable, Stack,Enumeration interface, Iteration over Collections – Iterator and ListIterator interfaces. **File Handling:** Stream classes, Reader and Writer classes, File and Directory class.

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. Handling button 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).

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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&SaurabhChoudhary: “Programming in Java”, 2nd Edition, Oxford University Press, 2014.
2. K. Arnold and J. Gosling, “The JAVA programming language”, 3rd Edition, Pearson Education, 2000.
3. Timothy Budd, “Understanding Object-oriented programming with Java”, Addison-Wesley, 2002.
4. C. Thomas Wu, “An introduction to Object-oriented programming with Java”, 4th edition, Tata McGraw-Hill Publishing company Ltd., 2010.
5. James M Slack, Programming and Problem Solving with JAVA, Thomson Learning, 2002.

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16IT C11

COMPUTER ORGANIZATION AND MICROPROCESSORS

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 familiarize students with the design and organization of a digital computer, operation of various functional units, instruction set design and factors that influence the performance of a computer.
2. To present students with concepts of memory system and its types.
3. To facilitate students with the understanding of architecture and instruction set of 8085 in particular and programming 8085.
4. To facilitate students with the understanding of the functionality and interfacing of various peripheral devices.

Course Outcomes:

After successful completion of this course, student will be able to

1. Understand and analyze the performance of computer systems and know how to improve their efficiency.
2. Get acquainted with the concepts of computer Arithmetic operations.
3. Understand the internal organization of memory system and various types of memory unit.
4. Understand the architecture and instruction set of 8085.
5. Write assembly language programs using 8085 instruction set.
6. Understand interfacing with various peripheral devices.

Prerequisites:

Digital Electronics and Logic Design (16ITC04).

UNIT I

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi-computers, Historical perspective. **Arithmetic:** Addition and Subtraction of Signed numbers: Addition/Subtraction Logic Unit, Design of fast adders: Carry – Look-ahead Addition, Multiplication of positive numbers, Signed-Operand Multiplication: Booth Algorithm, Fast Multiplication: Bit-Pair Recording of Multipliers, Carry-Save addition of Summands, Integer Division, Floating Point Numbers and Operations: IEEE Standard for Floating-Point Numbers, Arithmetic Operations on

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Floating-Point Numbers, Guard Bits and Truncation, Implementing Floating-Point Operations.

UNIT II

The Memory System: Basic concepts, Semi-conductor RAM Memories: Internal Organization of Memory Chips, Static Memories, Asynchronous DRAMs, Synchronous DRAMs , Structure of Larger Memories, Memory System Considerations, Rambus Memory, Read-Only Memories: ROM, PROM, EPROM, EEPROM, Flash Memory, Speed, Size and Cost, Cache Memories**:** Mapping Functions, Replacement Algorithms, Performance considerations: Interleaving, Hit rate and Miss Penalty, Caches on the Processor Chip, Other Enhancements. Virtual Memories: Address Translation, Memory Management requirements, Secondary Storage: Magnetic Hard Disks, Optical Disks and Magnetic Tape Systems.

UNIT III

8085 Microprocessor Architecture: Introduction to Microprocessors, The 8085 MPU: The 8085 Microprocessor, Microprocessor Communication and Bus Timings, De-multiplexing the Bus AD7-AD0, Generating Control Signals, A Detailed Look at the 8085 MPU and its Architecture, Decoding and Executing an Instruction.

Programming the 8085: Introduction to 8085 instructions: Data Transfer Operations, Arithmetic Operation, Logic Operations, Branch Operations, Writing Assembly Language Programs, Debugging a Program. Programming techniques with Additional instructions: Programming Techniques-Looping, Counting and Indexing, Additional Data Transfer and 16-Bit Arithmetic Instructions, Arithmetic Operations Related to memory, Logic Operations: Rotate and Compare, Dynamic Debugging.

UNIT IV

Stacks and subroutines: Stack, Subroutine, Restart, Conditional CALL and RETURN instructions, Advanced Subroutine Concepts.

Interrupts: The 8085 Interrupt, 8085 Vectored Interrupts: TRAP, RST 7.5, 6.5, AND 5.5, Additional I/O Concepts and Processes: Programmable Interrupt Controller (8259A), Direct Memory Access (DMA) and 8257 DMA controller.

Interfacing Data Converters: Digital to Analog (D/A) Converters, Analog to Digital (A/D) Converters.

UNIT V

Programmable Peripheral Interface (Intel 8255A), Programmable Communication Interface (Intel 8251), Programmable Interval Timer (Intel 8253 and 8254), Programmable Keyboard /Display Controller (Intel 8279), Serial and Parallel bus Standards: RS 232 C and IEEE 488. Hardware controlled serial I/O using programmable chips: 8251.

Text Books:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", 5^{th} Edition, McGraw Hill, 2002.
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming and Applications with the8085", 5^{th} edition, Prentice Hall, 2002.

Suggested Reading:

1. M. M. Mano, "Computer System Architecture", 3^{rd} edition, Prentice Hall, 1994.
2. William Stallings, "Computer Organisation and Architecture, Design for Performance", Pearson, 9^{th} Edition, 2013.
3. Pal Chouduri, "Computer Organization and Design", Prentice Hall of India, 1994.
4. Douglass V. Hall,"Microprocessors and Interfacing: Programming and Hardware", 2^{nd} Edition.

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16IT C12

FUNDAMENTALS OF DATA SCIENCE

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 statistical tools for analyzing empirical data.
2. To Familiarize students with different types of regression models.
3. To introduce various types of tests for comparison of means and variances of different datasets.
4. To familiarize students with data structures in R and packages for effective representation of results.

Course Outcomes:

After successful completion of this course, student will be able to

1. Analyze data using Classification, Graphical and computational methods.
2. Apply statistical methods to data for inferences.
3. Perform descriptive analytics over massive data.
4. Create or read from external datasets.
5. Store, retrieve and manipulate using R data structures.
6. Perform data manipulation, statistical analysis and present their results in well-formatted textual and graphical formats.

UNIT-I

Descriptive statistics: Measure of Central Tendency (Mean, Median and Mode), Measure of Positions (Quartiles, Deciles, Percentiles and Quantiles), Measure of Dispersion (Range, Median, Absolute deviation about median, Variance and Standard deviation), Measure of Distribution (Skewness and Kurtosis), Dependent independent events and Bayesian Approach, Graphical Analysis: Histograms and frequency polygons, Box-plots-Box and Whisker Plot-Box Plot and its parts, Using Box Plots to compare distribution,Scatter Plots, Heat Maps.

UNIT-II

Random variables and Regression Models: Overview of Random variables and distributions, Mathematical expectation, variance and covariance, Linear Regression: Correlation coefficient, Simple, multiple and logistic regressions, LDA and comparison of classification methods.

UNIT-III

Inferential statistics: Comparing Population-Test of Hypothesis (Concept of Hypothesis testing, Null Hypothesis and Alternative Hypothesis),

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Tabulations (Contingency table and their use, Chi-Square test, F-test), One Sample t-test (Concept, Assumptions, Hypothesis, Verification of assumptions, Performing the test and interpretation of results), Independent Samples t-test (Concept, Type, Assumptions, Hypothesis, Verification of assumptions, Performing the test and interpretation of results), Paired Samples t-test (Concept, Assumptions, Hypothesis, Verification of assumptions, Performing the test and interpretation of results), One way ANOVA (Concept, Assumptions, Hypothesis, Verification of assumptions, Model fit, Hypothesis testing).

UNIT-IV

Introduction to R: Installing R in windows, R Console (R window to edit and execute R Commands), Commands and Syntax (R commands and R syntax), Packages and Libraries (Install and load a package in R), Help In R, Workspace in R.

Familiarity of Data Structures in R: Introduction to Data Types (Why Data Structures?, Types of Data Structures in R), Vectors, Matrices, Arrays, Lists, Factors, Data Frames, Importing and Exporting Data.

UNIT-V

Graphical Analysis using R: Creating a simple graph (Using plot() command), Modifying the points and lines of a graph (Using type, pch, font, cex, lty, lwd, col arguments in plot() command), Modifying Title and Subtitle of graph (Using main, sub, col.main, col.sub, cex.main, cex.sub, font.main, font.sub arguments in plot() command), Modifying Axes of a Graph (Using xlab, ylab, col.lab, cex.lab, font.lab, xlim, ylim, col.axis, cex.axis, font.axis arguments and axis() command), Adding Additional Elements to a Graph (Using points(), text(), abline(), curve() commands), Adding Legend on a Graph (Using legend() command), Special Graphs (Using pie(), barplot(), hist() commands), Multiple Plots (Using mfrow or mfcol arguments in par() command and layout command).

Text Books:

1. Fundamentals of Mathematical statistics by S.C. Gupta and V.K. Kapur, Eleventh Edition Sultan Chand &Sons publications (Reprint) 2014. (Units 1,2 and 3).
2. An Introduction to Statistical Learning with Applications in R, Gareth James Daniela Witten Trevor Hastie, Robert Tibshirani, February 11, 2013, web link: www.statlearning.com. (Units 4 and 5).

Suggested Reading:

1. Beginning R The statistical Programming Language, Mark Gardener , Wiley, 2015.
2. Data Science and Big Data Analytics, EMC Education Services, EMC^2, Wiley Publication, 2015.

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16MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

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

Course Objectives:

The Objectives of the course are

1. to introduce managerial economics and demonstrate its importance in managerial decision making.
2. to develop an understanding of demand and relevance of its forecasting in the business.
3. to provide the basics of market structure and the concept of equilibrium in different market structures.
4. to examine the economic analysis of production process, types of inputs and to explain different costs and their relationship with the output.
5. to understand the importance of project evaluation in achieving a firm's objective.
6. to explain the concept of Accountancy and provided knowledge on preparation and analysis of Final accounts.

Course Outcomes:

After 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. Understand price determination for different markets.
4. Study production theory and analyze various costs & benefits involved in it so as to make best use of resources available.
5. Analyze different opportunities and come out with best feasible capital investment decisions.
6. Apply accountancy concepts and conventions, Final accounts and financial analysis.

UNIT-I:

Introduction to Managerial Economics

Introduction to Economics and its evolution - Managerial Economics - its scope, importance, Its usefulness to engineers - Basic concepts of Managerial economics.

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UNIT-II:

Demand Analysis

Demand Analysis - Concept of demand, determinants, Law of demand, its assumptions, Elasticity of demand, price, income and cross elasticity, Demand Forecasting – Types of Market structures. (Simple numerical problems).

UNIT-III:

Production and Cost Analysis

Theory of Production - Firm and Industry - Production function - input-out relations - laws of returns - internal and external economies of scale. Cost Analysis: Cost concepts - fixed and variable costs - explicit and implicit costs - out of pocket costs and imputed costs - Opportunity cost - Cost output relationship - Break-even analysis. (Theory and problems).

UNIT-IV:

Accountancy

Book-keeping, principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments.

UNIT-V:

Capital Budgeting

Introduction to capital budgeting, Methods: traditional and discounted cash flow methods. Introduction to Working capital management. (Numerical problems).

Text Books:

1. Mehta P.L., "Managerial Economics – Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2013.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 2013.
3. Panday I.M. "Financial Management", Vikas Publishing House, 11th edition, 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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16IT C13

JAVA PROGRAMMING 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. Be able to use the Java SDK environment to create, debug and run simple Java programs.
2. To build development skills using java programming for real world applications.
3. To implement frontend and backend of java based applications.

Course Outcomes:

After successful completion of this course, student will be able to

1. Develop Java applications using the concepts of Inheritance, interfaces, packages, access control specifiers.
2. Implement the concepts of Exception Handling in java Applications.
3. Read and write data using different Java I/O streams.
4. Create graphical user interfaces and Applets by applying the knowledge of Event Handling.
5. Create robust applications using Java standard class libraries and retrieve data from a database with JDBC.
6. Ability to solve real-world problems by designing user friendly GUI with befitting backend through the APIs of Java.

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, Dynamic polymorphism.
3. Program(s) to illustrate concept of abstract class & interfaces, Comparator and Comparable interfaces.
4. Program(s) to demonstrate String handling 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 defined exceptions.
7. Program(s) using Generics, Collection framework classes and Interfaces.
8. Program(s) to illustrate the usage of I/O streams.

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9. Program(s) to illustrate GUI with different controls, event handling and applets.
10. Program to connect to a database using JDBC.

Suggested Reading:

1. Herbert Schildt: “Java^{TM}: The Complete Reference Java”, 8^{th} edition, Tata McGraw Hill Publications, 2011.
2. Sachin Malhotra&SaurabhChoudhary: “Programming in Java”, 2^{nd} Edition, Oxford University Press, 2014.

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16IT C14

MICROPROCESSORS 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 familiarize students with the architecture and Instruction set of Intel 8085 microprocessor.
2. To provide practical hands on experience with Assembly Language Programming.
3. To impart skills required to interface various peripheral devices with 8085 microprocessor.

Course Outcomes:

After successful completion of this course, student will be able to

1. Describe the architecture and comprehend the instruction set of 8085.
2. Understand and apply the principles of Assembly Language Programming in developing microprocessor based applications.
3. Write assembly language programs using Arithmetic and logic instructions.
4. Write assembly language programs using branch and conditional instructions.
5. Write assembly language programs using stacks and sub routines.
6. Work with standard microprocessor interfaces like stepper motor, digital-to-analog Converters and analog-to-digital converters etc.

Prerequisites:

Digital Electronics and Logic Design (16ITC04).

List of Experiments

1. Introduction to 8085 instruction setand microprocessor trainer kit.
2. Assembly language programs using Arithmetic and logic instructions.
3. Assembly language programs using branch and conditional instructions.
4. Assembly language programs using stacks and sub routines.
5. Interfacing and programming of 8255. (E.g. traffic light controller).
6. A/D converter interface.
7. D/A converter interface.
8. Speed and Direction Control of Stepper Motor.
9. Practice Programs using 8085 Simulator.

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Text Books:

1. Ramesh S Gaonkar, “Microprocessor Architecture, Programming and Applications withthe 8085”, 5th edition, Prentice Hall, 2002.

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16IT C15

MINI PROJECT – II

Instruction	2 Hours per week
Duration of Semester End Examination	-
Semester End Examination	-
CIE	50 Marks
Credits	1

Course Objectives:

1. To learn by doing, by taking responsibility of the end product.
2. To develop capability to analyse and solve real world problems with an emphasis on applying/integrating knowledge acquired.

Course Outcomes:

After successful completion of this course, student will be able to

1. Construct innovative solutions.
2. To work in team as well as individuals.
3. To manage time and resources.

The Students are required to implement one of the projects from project exercise given in the suggested readings of the theory subjects. Focus may be on File structures, Micro Processor Based Projects. 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.

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IT 211

DISCRETE STRUCTURES

Instruction	4 periods per week
Duration of Semester-End Examination	3Hours
Semester-End Examination	75Marks
Sessional	25Marks
Credits	3

Course Objectives:

1. Learn mathematical concepts like sets, functions, logic and be able to apply them in solving logic oriented problems and introduce useful abstractions in problem solutions and representations that have application in many areas of computer science
2. Students will be able to use graphs to model relationships, analyse data, apply probability concepts and use recursive functions and solve problems.
3. Further develop the mathematical concepts and technique which should serve as a preparation for more advanced quantitative courses.

Course Outcomes:

Upon successful completion of this course

1. Students get acquainted with the precise vocabulary and powerful notation used in formal computer science study
2. Improved thinking skills will enhance the quality of work in area of computer science.
3. Students will be able to solve complex problems using logic.

Prerequisites:

1. Elementary Algebra.
2. Introductory computer science course with C and C++

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, Applications of Inclusion – Exclusion.

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UNIT – IV

Relations: Relations & their Properties, N-ary Relations and Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings.

Graphs: Graphs and Graph Models, Graph Terminology, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest Path Problems, Planar Graphs, Graph Coloring.

UNIT –V

Trees: Introduction to Trees, Application of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

Boolean Algebra: Boolean function, Representing Boolean functions, Logic Gates, Minimization of Circuits.

Textbook

1. Kenneth H Rosen, "Discrete Mathematics and its applications", Sixth Edition, McGraw Hill, 2006.

Suggested Reading

1. J. K. Sharma, "Discrete Mathematics", Second edition, Macmillan, 2005.
2. J.P.Trembly, R.Manohar, "Discrete Mathematical Structure with Application to Computer Science", McGraw- Hill – 1997.
3. Joel. Mott. Abraham Kandel, T.P.Baker, "Discrete Mathematics for Computer Scientist &Mathematicans", Prentice Hail N.J.,
4. C.L. Liu, "Elements of Discrete mathematics", McGraw-Hill, Third Edition.
5. U.S. Gupta, "Discrete Mathematical Structures", Pearson, 2014.

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IT 212

DATA STRUCTURES

Instruction	4 periods per week
Tutorial	1 period per week
Duration of Semester- End Examination	3 Hours
Semester- End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To develop proficiency in the specification, representation, and implementation of abstract data types and data structures.
2. To get a good understanding of applications of data structures.
3. To develop a base for advanced computer science study.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Choose the data structures that effectively model the information in a problem.
2. Design, implement, test, and debug programs using a variety of data structures including hash tables, binary and general tree structures, search trees, heaps, graphs, and B-trees.
3. Assess how the choice of data structures and algorithm design methods impacts the performance.

Prerequisites:

Good programming knowledge in C & CPP.

UNIT- I

Arrays, Linked Lists, and Recursion: Using Arrays, Storing Game Entries in an Array, Sorting 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, Implementing a Generic 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, Queues, and Deques: 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.

List and Iterator ADTs: Lists, Node-Based Operations and Iterators, The List Abstract Data Type, STL Lists, STL Containers and Iterators.

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UNIT- III

Trees: General Trees, Tree Definitions and Properties, Tree Functions, A C++ Tree Interface, A Linked Structure for General Trees, Tree Traversal Algorithms, Depth and Height, Preorder Traversal, Postorder Traversal, 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.

Heaps and Priority Queues: The Priority Queue Abstract Data Type, Keys, Priorities, and Total Order Relations, Comparators, The Priority Queue ADT, A C++ Priority Queue Interface, Sorting with a Priority Queue, 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, Bottom-Up Heap Construction.

UNIT- IV

Search Trees: Binary Search Trees, Searching, Update Operations, C++ Implementation of a Binary Search Tree, AVL Trees, Update Operations, Splay Trees, Splaying, When to Splay, Amortized Analysis of Splaying, Tree, Multi-Way Search Trees, Update Operations for (2,4) Tree, Red-Black Trees, Update Operations.

Graph Algorithms: 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, Implementing Depth-First Search, Breadth-First Search, Directed Graphs, Traversing a Digraph, Transitive Closure, Directed Acyclic Graphs, Shortest Paths, Weighted Graphs, Dijkstra's Algorithm, Minimum Spanning Trees, Kruskal's Algorithm, The Prim-Jarn´ık Algorithm.

UNIT- V

Hash Tables: Hash Tables, Bucket Arrays, Hash Functions, Hash Codes, Compression functions, Collision-Handling Schemes, Load Factors and Rehashing.

Sorting: Merge-Sort , Divide-and-Conquer, Merging Arrays and Lists, The Running Time of Merge-Sort , Merge-Sort and Recurrence Equations, Quick-Sort, Randomized Quick-Sort, Studying Sorting through an Algorithmic Lens, A Lower Bound for Sorting, Linear-Time Sorting: Bucket-Sort and Radix-Sort, Comparing Sorting Algorithms.

Strings: Pattern Matching Algorithms, Brute Force, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Tries, Standard Tries, Compressed Tries, Suffix Tries.

Text Book:

1. Michael T. Goodrich, Roberto Tamassia, David M. Mount, "Data Structure and Algorithms in C++", 2^{nd} Edition, John Wiley, 2011.

Suggested Reading:

1. Ellis Horowitz, Dinesh Mehta, S. Sahani, "Fundamentals of Data Structures in C++", Universities Press, 2007.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3^{rd} edition Addison-Wesley, 2007.
3. Bruno R. Preiss, "Data Structures and Algorithms with Object-Oriented Design Patterns in C++", John Wiley & Sons, 2001.
4. D. Samantha, "Classic Data Structures", Prentice Hall India, 2^{nd} Edition, 2013.
5. Langsam, Augenstein&Tenenbaum,"Data Structures Using C & C++", 2^{nd} edition, Prentice Hall

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IT 213

DIGITAL ELECTRONICS & LOGIC DESIGN

Instruction	4 periods per week
Duration of Semester- End Examination	3 Hours
Semester- End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To familiarize the students with the principles of digital Hardware.
2. To explain the operation and design of combinational and arithmetic logic circuits.
3. To facilitate with the concepts of HDL tools.

Course Outcome:

After taking the course, the students will be able to

1. Design complex logic circuits, do simplification, analysis and synthesis.
2. Understand the principles of different combinational and arithmetic logic designs.
3. Know the working principles of Latches, Flip-flops, and counters.

Prerequisites:

Physics and Mathematics.

UNIT – I

Design Concepts – Digital Hardware, Design process, Design of digital hardware Introduction to logic circuits – Variables and functions, Logic gates and networks. Boolean algebra, Synthesis using AND, OR, and NOT Gates, Design examples. Optimized implementation of logic functions – Karnaugh Map, Strategies for minimization, minimizing Product-of-Sum Forms, Incompletely Specified functions, multiple output circuits. NAND and NOR logic networks, Introduction to CAD tools and Very High Speed Integrated Circuit Hardware Description Language (VHDL).

UNIT – II

Programmable logic devices: general structure of a Programmable Logic Array (PLA), gate level diagram, schematic diagram, Programmable Array Logic (PAL) Structure of CPLDs and FPGAs, 2-input and 3-input lookup tables (LUT). Design of Arithmetic-circuits, VHDL for Arithmetic-circuits Combinational circuit building blocks – Multiplexers, Decoders, Encoders, Code converters, Arithmetic comparison circuits. VHDL for Combinational circuits.

UNIT – III

Basic Latch Gated SR Latch, Gated D Latch, Master-Slave and Edge- Triggered D Flip-Flops, D Flip-Flops with Clear and Preset. T Flip-flop, JK Flip-flop, Excitation tables. Registers-Shift Register, Parallel-Access Shift Register, Counters-Asynchronous and synchronous counters, BCD counter, Ring counter, Johnson counter, Registers and Counters in VHDL Code.

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UNIT – IV

Synchronous Sequential Circuits – Basic design steps.State-Assignment problem Moore and Mealy state model.Design of Finite state machines using VHDL.State minimization, FSM as an Arbiter Circuit, Analysis of Synchronous sequential Circuits. Algorithmic State Machine (ASM) charts, formal model.

UNIT – V

Asynchronous Sequential Circuits – Behaviour, Analysis, Synthesis, State reduction, State Assignment, examples. Hazards: static and dynamic hazards. Significance of Hazards. Clock skew, set up and hold time of a flip-flop, Shift and add multiplier, data path circuit for the multiplier, ASM chart and data path circuit for the divider control circuit, sort operation.

Text book:

1. Stephen Brown, ZvonkoVranesic, “Fundamentals of Digital Logic with VHDL design”, 2^{nd} Edition, McGraw Hill, 2009.

Suggested Reading:

1. Jain R.P., “Modern Digital Electronics,” 3^{rd} edition, TMH, 2003.
2. John F. Wakerly, “Digital design Principles & Practices”, 3^{rd} edition, Prentice Hall, 2001
3. M. Morris Mano, Charles R. Kime, “Logic and Computer Design Fundamentals”, 2^{nd} edition, Pearson Education Asia, 2001.
4. ZVI Kohavi, Switching and Finite Automata Theory, 2^{nd} edition, Tata McGraw Hill, 1995.
5. William I Fletcher, “An Engineering Approach to Digital Design”, Eastern Economy Edition, PHI
6. H.T. Nagle, “Introduction to Computer Logic”, Prentice Hall, 1975.

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IT 214

DATA COMMUNICATIONS

Instruction	4 periods per week
Duration of Semester- End Examination	3 Hours
Semester- End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

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

1. Familiarize with the basics of data transmission, transmission media, data Communications System and its components.
2. Describe various encoding and modulation schemes, various data link protocols for flow control, error detection and correction.
3. Understand different types of multiplexing and spread spectrum techniques, Familiarize with different types of Ethernet and to understand the architecture and services of WLANs and Bluetooth.

Course Outcomes:

After completing this course the student should acquire the knowledge and ability to:

1. Demonstrate systematic understanding of Data Communication Techniques and solve problems related to data communications.
2. Apply appropriate Analytical Techniques to critically evaluate communication processes.
3. Familiarize with the basic protocols of data link layer and prepared to take the computer networks course.

Prerequisites:

Engineering physics

UNIT-I

Data Communications, Data Networks and The Internet: Data Communications and Networking for Today's Enterprise, Communications Model, Data Communications, Networks, The Internet, An Example Configuration

The Need for a Protocol Architecture, The TCP/IP Protocol Architecture, The OSI Model, Standardization within a Protocol.

Data Transmission: Concepts and Terminology, Analog and Digital Transmission, Transmission Impairments, Transmission media.

UNIT-II

Data Encoding: Digital Data Digital Signals, Digital Data-Analog Signals, Analog Data-Digital Signals, Analog Data-Analog Signals.

Data Communication Interface: Asynchronous and Synchronous Transmission, Line Configuration, Interfacing.

Data Link Control: Flow Control, Error Detection, Error Control, HDLC, Other Data link Control Protocols, Performance Issues.

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UNIT - III

Multiplexing: Frequency Division Multiplexing, Wavelength Division Multiplexing, Synchronous TimeDivision Multiplexing, Statistical TimeDivision Multiplexing. Asymmetric Digital Subscriber Line, xDSL.

Spread Spectrum: The Concept, Direct Sequence Spread Spectrum, Frequency Hopping Spread Spectrum, Code Division Multiple Access.

UNIT -IV

Circuit Switching and Packet Switching: Switched Communications Networks, Circuit-Switching Networks,Circuit-Switching Concepts, Soft switch Architecture,Packet-Switching Principles,X.25,Frame Relay.

ATM : Architecture, Logical Connection, ATM Cells, Transmission of ATM cells.

UNIT -V

Traditional Ethernet: Topologies and Transmission Media, LAN protocol architecture, MAC sub layer, CSMA/CD, Physical Layer, Bridged, Switched and Full Duplex Ethernets

Fast Ethernet: MAC sub Layer, Physical layer, Gigabit Ethernet: MAC sub Layer, Physical Layer

Wireless LANs: Overview, Wireless LAN Technology, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control, IEEE 802.11 Physical Layer.

Bluetooth: Architecture, Layers.

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", 4th edition, Tata McGraw Hill, 2006.
2. William Stallings, "Data and Computer communication", 8th edition, Pearson Education, Asia-2004.

Suggested Reading:

1. Fred Halsall, "Data Communications, Computer Networks and Open Systems", 4th edition, Pearson Education, 2000.
2. Andrew S. Tanenbaum, "Computer Networks", 5th edition, Pearson Education.
3. Gilbert Held, "Understanding Data Communications", 7th Edition, Pearson Education.
4. Nader F.Mir, "Computer and Communication Networks, 7th edition, Prentice Hall,

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EC 215

BASIC ELECTRONICS
(Common for CSE, IT, MECH, PROD)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To understand the knowledge of basic semiconductor devices and create foundation for forthcoming circuit design courses
2. To understand various applications like amplifiers, oscillators and op-amps also motivate and train students in logic design.
3. To understand the working principle of the transducers and aware the students about the advances in Instrumentation.

Course Outcomes:

1. Ability to understand the usefulness of semiconductor devices in circuit making like rectifiers, filters, regulators etc.
2. Ability to develop new directions in logic design to analyze, design and implement combinational circuits.
3. Ability to analyze the principles and practices for instrument design to development the real world Problems.

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.

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Digital System: Review of basic gates, Universal gates, Demorgan's theorem, minimization with Karnaugh Map up to three variables and realization of half, Full Adder and half, Full Sub tractors.

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, Reprinted, 1985.
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.
4. S. Shalivahan, N. Suresh Kumar, A Vallavea Raj, "Electronic Devices and Circuits", Tata McGraw Hill, 2003

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MB 214

MANAGERIAL ECONOMICS AND ACCOUNTANCY

Instruction:	4L periods per week
Duration of Main Examination	3 Hours
Main Examination	75 Marks
Internal Examination	20 Marks
Case Study/ Assignment	5 Marks
Credits	3

Objective: The objective of the course is to provide the analytical tools and managerial insights that are essential for the solution of those business problems that have significant consequences for the firm and society.

UNIT-I: Introduction to Managerial Economics
Introduction to Economics and its evolution - Managerial Economics - its scope, importance, Its usefulness to engineers - Basic concepts of Managerial economics.

UNIT-II:Demands Analysis
Demands Analysis - Concept of demand, determinants, Law of demand, its assumptions, Elasticity of demand, price, income and cross elasticity, Demand Forecasting - Markets Competitive structures, price-output determination under perfect competition and Monopoly. (Theory questions and small numerical problems can be asked).

UNIT-III: Production and Cost Analysis
Theory of Production - Firm and Industry - Production function - input-out relations - laws of returns - internal and external economies of scale. Cost Analysis: Cost concepts - fixed and variable costs - explicit and implicit costs - out of pocket costs and imputed costs - Opportunity cost - Cost output relationship - Break-even analysis. (Theory and problems).

UNIT-IV:Capital Management
Capital Management, its significance, determinants and estimation of fixed and working capital requirements, sources of capital - Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems.
(Theory questions are numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked).

UNIT-V: Accountancy
Book-keeping, principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments.
(Theory questions and numerical problems on preparation of final accounts, cash book, petty cash book, bank reconciliation statement).

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Essential Readings:

1. Mehta P.L., “Managerial Economics – Analysis, Problems and Cases”, Sulthan Chand & Son’s Educational publishers, 2011.
2. Maheswari S.N. “Introduction to Accountancy”, Vikas Publishing House, 2005.
3. Panday I.M. “Financial Management”, Vikas Publishing House, 2009.

Suggested Readings:

1. Varshney and KL Maheswari, Managerial Economics, Sultan Chand, 2001.
2. M.Kasi Reddy and S.Saraswathi, Managerial Economics and Financial Accounting, Prentice Hall of India Pvt Ltd, 2007.
3. JC Pappas and EF Brigham, Managerial Economics.

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IT 215

DATA STRUCTURES LAB

Instruction	4 periods per week
Duration of Semester- End Examination	3 Hours
Semester- End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. The fundamental design, analysis, and implementation of basic data structures and algorithms.
2. Understand data structures such as Trees, Threaded Binary Trees, Heaps, etc.
3. Be familiar with graph operations and algorithms.
4. Get familiar with advanced tree structures like AVL, Splay, m-way, B-Trees.

Course Outcomes:

Student will be able to

1. Choose the data structures that effectively model the data in a problem.
2. Design, implement, test, and debug programs using a variety of data structures including hash tables, binary and general tree structures, heaps, graphs, and B-trees.
3. Choose the appropriate data structure and algorithm design method for a specified application.

Prerequisites:

Good programming knowledge in C & CPP.

List of Programs

1. Implement String ADT.
2. Implement Infix to Postfix Conversion and evaluation of postfix expression using Stack.
3. Implementation of Queues, Circular Queues and Deques.
4. Implementation of Single Linked List and its operations.
5. Implementation of Double Linked List and its operations.
6. Implementation of Binary Search and Hashing.
7. Implementation of Sorting Techniques: Insertion, Bubble, Selection, Shell, Merge, Quick, Heap.
8. Implementation of Tree Traversals on Binary Trees.
9. Implementation of operations on AVL Trees.
10. Implementation of Traversal on Graphs.
11. Implementation of Splay Trees.

Suggested Reading:

1. Michael T. Goodrich, Roberto Tamassia, David M. Mount, "Data Structure and Algorithms in C++", 2nd Edition, John Wiley, 2011.
2. Ellis Horowitz, Dinesh Mehta, S. Sahani, "Fundamentals of Data Structures in C++", Universities Press, 2007.
3. K. R. Venugopal, "Mastering C++", Tata McGraw-Hill Publishing Company, 1997
4. D. Samantha, "Classic Data Structures", Prentice Hall India, August 2004.
5. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd edition, Addison-Wesley, 2007

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With effect from Academic Year 2014-15

EC 218

BASIC ELECTRONICS LAB

(Common for CSE, IT, MECH, PROD)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

The main objectives of this course are:

1. To study the electronics components.
2. To study characteristics of semi-conductor devices.
3. To study simple electronic circuits.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Understand the knowledge regarding electronic components and equipment.
2. Design various rectifiers and filters .Analysis of characteristic behavior of BJT , FET
3. Design of an amplifier.
4. Verify the operation of Op-amp for various applications.

List of Experiments:

1. Study of Electronic components.
2. Characteristics of Semiconductor diodes (Germanium, Silicon 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. Verification of Logic gates
12. Realization of Half and Full adder

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Suggested Reading:

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", 3rd Edition.

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IT 216

MINI PROJECT - I

Instruction	3 periods per week
Sessional	25 Marks
Credits	1

Course Objectives:

1. To learn by doing, by taking responsibility of the end product.
2. To develop capability to analyse and solve real world problems with an emphasis on applying/integrating knowledge acquired.

Course Outcomes:

Students should be able to do the following:

1. Construct innovative solutions.
2. To work in team as well as individuals.
3. To manage time and resources.

The Students are required to implement one of the projects from project exercise given in the suggested readings of the theory subjects. 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.

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MT 222

PROBABILITY AND RANDOM PROCESSES

Instruction	4 periods per week
Duration of Semester-End Examination	3Hours
Semester-End Examination	75Marks
Sessional	25Marks
Credits	3

Course Objectives:

1. To induce the ability to describe a random experiment in terms of procedure, observation, and a Probability model.
2. To inculcate ability to characterize functions of random variables
3. To impart the students the methods to characterize stochastic processes with an emphasis on stationary random processes.

Course outcomes:

1. The student is expected to characterize jointly multiple discrete and continuous random variables
2. The student must be able to describe conditional and independent events and conditional random variables.
3. Learn the techniques to describe independent events and independent random variables and their sums.

UNIT-I

The meaning of Probability-Introduction, definitions-Probability and Induction-Causality versus Randomness.

The Axioms of probability: Set theory-Probability Space- Conditional Probability.

Repeated trials: combined experiments-Bernoulli's trials –Bernoulli's theorem and games of chance.

UNIT-II

The concept of Random variable: Introduction-Distribution and density functions-Specific random variables-Conditional distributions-Asymptotic Approximations for Binomial approximations.

Functions of one random variables: The random variable g(x)- The distribution of g(x)-Mean and variance-moments – Characteristic Function.

UNIT-III

Two random variables: Bivariate distributions-one function of two random variables -Two function of two random variables-joint moments-joint characteristic functions-conditional distributions- conditional Expected Probability function.

UNIT-IV

Random Process: Definitions- Basic concepts and examples-Stationary and ergodicity-second order properties- Spectral representation Winer-Kinche Theorem.

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UNIT-V

Linear Operations: Gaussian Processes-Poisson process- Low pass and band pass noice representations.

Text Books:

1. T.Veerarajan "Probability, Statistics and Random Process", Tata Mc Graw Hill company Pvt. Ltd. Third Edition, 2010
2. P.Ramesh Babu "Probability Theory and Random Processes", Tata McGraw Hill Education Private Limited First Edition-2014
3. S. C.Gupta and V.K.Kapoor "Mathematical Statistics", Sultan Chand & Sons Tenth Edition, 2000.

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IT 221

JAVA PROGRAMMING

Instruction	4 Periods per week
Duration of Semester- End Examination	3 Hours
Semester-End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To understand fundamentals of object-oriented programming in Java which includes defining classes, invoking methods, using class libraries.
2. To create Java application programs using sound OOP practices such as interfaces, APIs and error exception handling.
3. Using API to solve real world problems.

Course Outcomes:

At the end of this course student will:

1. Achieve proficiency in object-oriented concepts and also learns to incorporate the same into the Java programming language.
2. Develop programming skills and implement problem-solving techniques using OOP concepts.
3. Develop the ability to solve real-world problems through software development in high-level programming language and Large APIs of Java.

Prerequisites:

1. Should have programming knowledge in high level language such as C.
2. Should have basic concepts of OOPs.

UNIT-I

Introduction To Java: Objects, Classes, Java Programs, Introduction to jdk and jre, Java Primitive Types, Basic Operators, Conditional and Logical statements, Some Typical Differences Between C and Java.

Defining Classes: Adding Instance Fields and Methods, Constructors, Access Modifiers (Visibility Modes), Object Creation Examples, Method Overloading and Constructor Overloading, Use of static and final keywords, Objects as parameters, Difference between local variable and instance field, Introduction to Object class, How to read user input (from keyboard).

UNIT-II

Arrays, Strings in Java: How to create and define arrays, Introduction to java.util.Array class, Difference between String &StringBuffer classes, StringTokenizer class and Wrapper classes and conversion between Objects and primitives

Inheritance, Interfaces and Packages in Java: Defining super / sub classes, Abstract classes, Method overriding, Interfaces, Using Library Interfaces [Comparable and Comparator], Creating and Defining Packages;

Inner classes in Java: Types of inner classes, Creating static / non-static inner classes, Local and anonymous inner classes.

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UNIT-III

Exception Handling in Java: What are exceptions, writing your own exception classes, [try, catch, throw, throws clauses] , Difference between checked Vs.unchecked Exceptions, Error Vs. Exception.

Multithreading in Java: what are threads, how to create threads, Thread class in java, use of synchronized keyword, how to avoid deadlock.

Generics and Frameworks: Generics, Collections Framework, Collection interfaces and classes ArrayList, LinkedList, Vector.

UNIT-IV

GUI Design & Event Handling: Component, Container, Color , GUI Controls, Layout Managers, Introduction to Swings, Events, Listeners, Icon interface, Writing GUI Based applications, Applets , Running Applets.

UNIT-V

File Handling: Stream classes, Reader and Writer classes, File and Directory class
Database Handling in Java: Java Database Connectivity (JDBC)

Text Book:

1. Herbert Schildt: “Java^{TM}: The Complete Reference Java”, Eighth Edition, Tata McGraw Hill Publications, 2011, ISBN: 9781259002465

Suggested Reading:

1. Cay S. Horstmann, Gary Cornell: “Core Java, Volume I--Fundamentals”, 8^{th} edition, Prentice Hall, 2008, ISBN: 9780132354790
2. K. Arnold and J. Gosling, “The JAVA programming language”, 3^{rd}edition, Pearson Education, 2000.
3. Timothy Budd, “Understanding Object-oriented programming with Java”, Addison-Wesley, 2002.
4. C. Thomas Wu, “An introduction to Object-oriented programming with Java”, 4^{th} edition, Tata McGraw-Hill Publishing company Ltd., 2006.
5. Deitel&Deitel, “Java: How to Program”, 9th Edition, PHI, 2014

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IT 222

DESIGN AND ANALYSIS OF ALGORITHMS

Instruction	4 periods per week
Tutorial	1 period per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:
1. To develop the problem solving capability using different algorithmic design techniques.
2. To learn how to analyse the asymptotic performance of algorithms and prove their correctness.
3. To introduce the notions of NP-completeness and NP-hardness.

Course Outcomes:
Students should be able to do the following:
1. Synthesize/adapt an algorithm to solve the problem in hand and argue its correctness.
2. Analyse best-, average- and worst-case complexities of algorithms using asymptotic notations.
3. Identify the complexity classes such as P, NP, NP-Complete and NP-Hard to which an algorithm belongs and design a feasible solution.

Prerequisites:
Programming language, Data Structures, Discrete mathematics, Basic probability theory.

UNIT-I

Introduction: Algorithm Specification, Performance analysis, Space Complexity, Time Complexity, Asymptotic Notation (O, Omega, Theta), Practical Complexities, Performance Measurement, Randomized Algorithms: An informal discussion, Review of elementary data structures : Stacks, Queues, Trees, Heap and Heap Sort, Set representation, UNION, FIND.

UNIT-II

Divide- and Conquer: The general method, Finding maximum 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 graph, Single source shortest path, All Pair Shortest Path, Optimal Binary Search trees, 0/1 Knapsack, Reliability Design, Traveling Salesperson Problem, **Techniques for Graph Traversal**: Breath First Traversal, Depth First Traversal, Connected Components and Spanning Trees, Bi-connected Components and Depth First Search.

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UNIT-IV

Backtracking : The General Method,8-Queens Problem, Graph Colouring, Hamilton cycle, Knapsack Problem, **Branch and Bounds:** The Method, LC Search, 15 puzzle, FIFO Branch and Bound, LC Branch and Bound, 0/1 Knapsack Problem, Traveling salesperson problem.

UNIT-V

NP-Hard and NP-Completeness: 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 Book:

1. Ellis Horowitz, SartajSahani and SanguthevarRajasekaran, Fundamentals of Computer Algorithm, 2^{nd}edition, Semester-End Press, 2011.

Suggested Reading:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 2^{nd}Edition, Prentice Hall of India Private Limited, 2006.
2. AnanyLevitin, "Introduction to the Design & Analysis of Algorithms", Pearson Education, 2003.
3. Aho, Hopcroft, Ullman, "The Design and Analysis of Computer Algorithm", Pearson Education, 2000.
4. ParagH.Dave, Himanshu B. Dave, "Design and Analysis of Algorithms", Pearson Education, Second Edition, 2014.

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IT 223

THEORY OF AUTOMATA

Instruction	4 periods per week
Tutorial	1 period per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To study, evaluate and explain the differences between different computational models, such as Turing machines, push-down automata, finite automata, etc.
2. To design solutions for problems using the different computational models (Pushdown Automata, Finite Automata, TMs).
3. To understand and work with grammars and representations of formal languages.

Course Outcomes:

Upon successful completion of this course, students should be able to have

1. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
2. An ability to apply knowledge of computing and mathematics appropriate to the discipline in the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices.
3. An ability to design, implements, and evaluate a computer-based system, process, component, or program to meet desired needs.

Prerequisites: Discrete Structures and Data Structures

UNIT-I

Automata: Introduction to Finite Automata, The Central Concepts of Automata Theory: Alphabets, Strings, 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, How a DFA Processes Strings? 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.

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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 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 Languageof 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, DPDA's to CFL's, DPDA's to Ambiguous Grammars.

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: Multitape Turing Machine, Equivalence of One-Tape and Multi-Tape TM's, Non deterministic Turing Machines, Restricted Turing Machines: TM's with Semi infinite Tapes, Multistack Machines, Counter Machines. Turing Machine and Computers: Simulating a Computer by a TM.

UNIT -V

Undecidability: A Language That Is Not Recursively Enumerable: Enumerating the Binary Strings, Codes for Turing Machines, The Diagonalization Language, An Undecidableproblemthat 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 UndecidableProblems.

Intractable Problems: The classes P and NP: Problems Solvable in Polynomial Time,Nondeterministic Polynomial Time, NP-Complete Problem.

Text book:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D Ullman, "Introduction to AutomataTheoryLanguages and Computation", Third 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
4. Computation)", 3rd edition,Prentice Hall of India 2008.
5. ShyamalendraKandar, "Introduction to Automata Theory, Formal Languages and Computation", Pearson, 2013.

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IT224

SOFTWARE ENGINEERING

Instruction	4 periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

This course introduces the students to

1. Understand the software life cycle models.
2. Understand the importance of the software development process.
3. Understand the importance of software quality and review techniques.

Course Outcomes:

1. An ability to apply knowledge of mathematics, science, and engineering.
2. An ability to design and conduct experiments, as well as to analyze and interpret data, conduct tests using various testing methods to verify and validate the results.
3. An ability to identify, formulate and implement software projects.

Pre-requisites: Knowledge of design, coding, and debugging programs.

UNIT-I

Software and Software Engineering: The Nature of Software, Software Engineering. The Software Process, Software Engineering Practice.Process Models: A Generic Process Model, Prescriptive Process Models, Specialized Process Models, The Unified Process, Process Technology, Product and Process, Process Assessment and Improvement, The CMMI, The people CMM,Introduction to Agile development.

Understanding Requirements: Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

Requirements Modeling: Requirements Analysis, Scenario-Based Modeling, Problem Analysis, Data Flow Diagrams, Data Dictionaries, Entity-Relationship diagrams, Software Requirement and Specifications, Behavioral and non-behavioral requirements, Software Prototyping.

UNIT-II

Design Concepts: Design within the Context of Software Engineering, The Design Process, Design Concepts. Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design.

Architectural Design: Software Architecture, Architecture Styles.

Component level Design: Designing Class-Based Components, Conducting Component-Level Design, Designing Traditional Components, Component-Based Development.

UNIT-III

Quality Concepts: Software Quality, Achieving Software Quality.

Review Techniques: Cost Impact of Software Defects.

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Software Quality Assurance: Background Issues, Elements of Software Quality Assurance, SQA Tasks, Goals and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance, Software Reliability, The ISO 9000 Quality Standards, The SQA Plan.

UNIT-IV

Software Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Validation Testing, System Testing, The Art of Debugging. Testing Tools –Rational functional tester, Win Runner, Load Runner, Testing Standards,Selenium software testing tool.

Testing Conventional Applications:

Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing, Control Structure Testing, Black–Box Testing, Software Configuration Management.

Product Metrics: A Framework for Product Metrics, Size Metrics like LOC, Token Count, Function Count, Design Metrics, Data Structure Metrics, Information Flow Metrics, Metrics for Testing, Metrics for Maintenance.

UNIT-V

Estimation: Observations on Estimation, The Project Planning Process, Software Scope and Feasibility, Resources, Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Specialized Estimation Techniques.

Risk Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan.

Text Books:

1. Roger S.Pressman, "Software Engineering: A Practitioners Approach" ,7^{th} edition, McGrawHill, 2009.

Suggested Reading:

1. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, "Fundamentals of Software Engineering", PHI, 2^{nd} edition.
2. Ali Behforoz and Frederic J.Hadson, "Software Engineering Fundamentals", Oxford Semester-End Press, 1996.
3. PankajJalote "An Integrated Approach to Software Engineering ", 3^{rd} edition, Narosa Publishing house, 2008.
4. James F.Peters, WitoldPedrycz, "Software Engineering-An engineering Approach", John Wiley Inc., 2000.

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IT 225

COMPUTER ORGANIZATION & MICROPROCESSORS

Instruction	4 periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To familiarize students with the design and organization of a digital computer, operation of various functional units, instruction set design and factors that influence the performance of a computer.
2. To facilitate students with the understanding of architecture and instruction set of 8085 in particular and programming 8085.
3. To facilitate students with the understanding of the functionality and interfacing of various peripheral devices.

Course Outcomes:

After completing the course, student should be able to

1. Understand and analyze the performance of computer systems and know how to improve their efficiency.
2. Understand the instruction set of 8085 and write assembly language programs.
3. Design new special purpose systems for various applications using appropriate peripheral interfacing.

Prerequisites:

Digital Electronics and Logic Design

UNIT-I

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi-computers, Historical perspective.

Arithmetic: Addition and Subtraction of Signed numbers: Addition/Subtraction Logic Unit, Design of fast adders: Carry – Look-ahead Addition, Multiplication of positive numbers, Signed-Operand Multiplication: Booth Algorithm, Fast Multiplication: Bit-Pair Recording of Multipliers, Carry-Save addition of Summands, Integer Division, Floating Point Numbers and Operations: IEEE Standard for Floating-Point Numbers, Arithmetic Operations on Floating-Point Numbers, Guard Bits and Truncation, Implementing Floating-Point Operations.

UNIT-II

The Memory System: Basic concepts, Semi-conductor RAM Memories: Internal Organization of Memory Chips, Static Memories, Asynchronous DRAMs, Synchronous DRAMs , Structure of Larger Memories, Memory System Considerations, Rambus Memory, Read-Only Memories: ROM, PROM, EPROM, EEPROM, Flash Memory, Speed, Size and Cost, Cache Memories**:** Mapping Functions, Replacement Algorithms, Performance considerations: Interleaving, Hit rate and Miss Penalty, Caches on the Processor Chip, Other Enhancements. Virtual Memories: Address Translation, Memory Management requirements, Secondary Storage: Magnetic Hard Disks, Optical Disks and Magnetic Tape Systems.

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UNIT-III

8085 Microprocessor Architecture: Introduction to Microprocessors, The 8085 MPU: The 8085 Microprocessor, Microprocessor Communication and Bus Timings, De-multiplexing the Bus AD_7-AD_0, Generating Control Signals, A Detailed Look at the 8085 MPU and its Architecture, Decoding and Executing an Instruction.

Programming the 8085: Introduction to 8085 instructions: Data Transfer (Copy) Operations, Arithmetic Operation, Logic Operations, Branch Operations, Writing Assembly Language Programs, Debugging a Program. Programming techniques with Additional instructions: Programming Techniques-Looping, Counting and Indexing, Additional Data Transfer and 16-Bit Arithmetic Instructions, Arithmetic Operations Related to memory, Logic Operations: Rotate and Compare, Dynamic Debugging.

UNIT-IV

Stacks and subroutines: Stack, Subroutine, Restart, Conditional CALL and RETURN instructions, Advanced Subroutine Concepts.

Interrupts: The 8085 Interrupt, 8085 Vectored Interrupts:TRAP, RST 7.5, 6.5, AND 5.5, Additional I/O Concepts and Processes: Programmable Interrupt Controller (8259A), Direct Memory Access (DMA).

Interfacing Data Converters: Digital to Analog (D/A) Converters, Analog to Digital (A/D) Converters.

UNIT-V

Programmable Peripheral Interface (Intel 8255A), Programmable Communication Interface (Intel 8251), Programmable Interval Timer (Intel 8253 and 8254), Programmable Keyboard /Display Controller (Intel 8279), Serial and Parallel bus Standards: RS 232 C and IEEE 488.

Text books:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, “Computer Organization”, 5th Edition, McGraw Hill, 2002.
2. Ramesh S Gaonkar, “Microprocessor Architecture, Programming and Applications with the8085”, 5th edition, Prentice Hall, 2002.

Suggested Readings:

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. Pal Chouduri, “Computer Organization and Design”, Prentice Hall of India, 1994.
4. Douglass V. Hall,“Microprocessors and Interfacing: Programming and Hardware”, 2nd Edition,

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IT226

JAVA PROGRAMMING AND ALGORITHMS LAB

Instruction	4 periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To build software development skills using java programming for real world applications.
2. To implement frontend and backend of an application
3. To implement classical problems using java programming.

Course Outcomes:

Students should be able to demonstrate the following.

1. Develop java based software applications using different IOs
2. Design user friendly GUI with befitting backend
3. Implement Algorithms using java programming

List of programs

1. Program(s) to illustrate the concepts polymorphism, abstract class,interface, String Handling and inner classes.
2. A program(s) for demonstrating different exceptions and creation of user defined exception.
3. A program to illustrate multithreading & thread synchronization.
4. Program(s) using Collection classes and Interfaces
5. Program(s) to illustrate the usage of filter and Buffered I/O streams.
6. An application involving GUI with different controls, event handling and applets.
7. A Program to connect to MySql database using JDBC.
8. A program to implement 0/1 Knapsack problem using Dynamic Programming.
9. A program single source shortest path using Dijkstra's algorithm.
10. A program to implement N Queen's problem using Back Tracking
11. A program to find the chromatic number of a given graph.
12. A program to obtain the Topological ordering of vertices in a given digraph.
13. A GUI based Applet Animation to implement the Travelling Salesperson problem.
14. A program to find the shortest path of the multistage graph using dynamic programming.

Suggested Reading:

1. Ellis Horowitz, SartajSahani and SanguthevarRajasekaran, “Fundamentals of Computer Algorithm”, 2nd edition, Semester-End Press, 2011.
2. Herbert Schildt: “JavaTM: The Complete Reference Java”, 8th edition, Tata McGraw Hill Publications, 2011.

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IT 227

MICROPROCESSORS LAB

Instruction	4 periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To become familiar with the architecture and Instruction set of Intel 8085 microprocessor.
2. To provide practical hands on experience with Assembly Language Programming.
3. To familiarize the students with interfacing of various peripheral devices with 8085 microprocessor.

Course Learning Outcomes:

After completing the course students should be able to

1. Describe the architecture and comprehend the instruction set of 8085.
2. Understand and apply the principles of Assembly Language Programming in developing microprocessor based applications.
3. Work with standard microprocessor interfaces like serial ports, digital-to-analog Converters and analog-to-digital converters etc.

Prerequisites:

Digital Electronics and Logic Design, Computer Organization

List of Experiments

1. 8085 Programming covering all its instructions on microprocessor trainer kit.
2. Interfacing and programming of 8255. (E.g. traffic light controller).
3. Interfacing and programming of 8254.
4. Interfacing and programming of 8279.
5. A/D and D/A converter interface.
6. Stepper motor interface.
7. Display interface.

Suggested Readings:

1. Ramesh S Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", 5th edition, Prentice Hall, 2002.

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IT 228

MINI PROJECT - II

Instruction	3 periods per week
Sessional	25 Marks
Credits	1

Course Objectives:

1. To learn by doing, by taking responsibility of the end product.
2. To develop capability to analyse and solve real world problems with an emphasis on applying/integrating knowledge acquired.

Course Outcomes:

Students should be able to do the following:

1. Construct innovative solutions.
2. To work in team as well as individuals.
3. To manage time and resources.

The Students are required to implement one of the projects from project exercise given in the suggested readings of the theory subjects. Focus may be on File structures,

Micro Processor Based Projects, Development of any Controller Circuits using CPLD's or FPGA's. 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.

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IT 311

PRINCPLES OF OPERATING SYSTEMS

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To develop an understanding of the services provided by an operating system.
2. To understand what a process is and how processes are synchronized and scheduled.
3. To understand different approaches for resourcemanagement and to provide security.

Course Outcomes:

Students who complete this course should be able to

1. Use system calls for managing processes, memory and the file system.
2. Select an efficient algorithm for optimizing the performance in different aspects of operating systems.

Prerequisites:

Computer Organization and Microprocessor, Programming language, Data Structures.

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.

Operating System Structures: Operating-System Services,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 Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems ofSynchronization, Monitors.

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Algorithm Evaluation.

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

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UNIT–III

Main Memory: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.

Virtual Memory: Background, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory, Mass-Storage Structure, Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Formatting, RAID Structure, Stable-Storage Implementation.

UNIT–IV

File-System Interface: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, Protection.

File-System Implementation: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance.

I/O Systems: Overview, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations.

UNIT–V

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.

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”, Ninth Edition, John wiley and sons publication,2013.

Suggested Reading:

1. A.Tanenbaum,”Modern Operation Systems”, Third Edition, Pearson Education, 2008.
2. William Stallings, “Operating Systems”, Fifth Edition, Pearson Education,2005.
3. Ida M.Flynn, “Understanding Operating Systems”, Sixth Edition, Cengage,2011.
4. D.M.Dhamdhere,”Operating systems a concept based approach”, SecondEdition, McGraw-Hill, 2007.
5. Pramod Chandra P.Bhatt,”AnIntoduction to Opearting Systems concepts and practice”, Third Edition, PHI, 2014.

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IT 312

DATABASE SYSTEMS

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To understand the different issues in the design and implementation of a databasesystem.
2. To understand the physical and logical database designs and various database models.
3. To study the concepts of database security,concurrency and recoverability.

Course Outcomes:

Students who complete this course should be able to

1. Design and implement a database for any specified domain according to well-known design principles that balance data retrieval performance with data consistency guarantees.
2. Formulate data retrieval queries in SQL and Relational algebra.
3. Apply normalization conceptin the design of a database.

Prerequisites:

Data Structures, Core Java.

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 RetrievalSpecialty Databases, Database Users and Administrators.

Database Design and the E-R Model: Overview of the Design Process, the Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues, Extended E-R Features, Alternative Notations for Modeling Data, Other Aspects of Database Design.

UNIT – II

Introduction to the RelationalModel: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages,Relational Operations.

Introduction to SQL: Overview of the SQL QueryLanguage, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database.

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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.

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, Implementation of Isolation Levels, Transactions as SQL Statements

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, Weak Levels of Consistency in Practice.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile, Storage, Early Lock Release and Logical Undo, Operations, ARIES, Remote Backup Systems.

Text book:

1. Abraham Silberschatz, Henry F Korth, S. Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill International Edition, 2010.

Suggested Reading:

1. Ramakrishnan, Gehrke, “Database Management Systems”, Third Edition, McGraw-Hill International Edition, 2003.
2. ElmasriNavathe, Somayajulu, “Fundamentals of Database System”, Fourth Edition, Pearson Education, 2006.
3. PatricO’Neil, Elizabeth O’Neil, “Database-principles, programming and performance”,Morgan Kaufmann Publishers, 2001.

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IT 313

COMPILER DESIGN

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To understand various phases in Compiler Design.
2. To design Parsers and generate code for target machine.
3. Understand the role of a symbol table and error recovery strategies.

Course Outcomes:

Students who complete the course should be able to

1. Understand the translation process of a compiler
2. Design top-down and bottom-up parsers.
3. Capable to design a compiler.

Prerequisites:

Structured Programming, Data Structures and Theory of Automata.

UNIT-I

Introduction: Programs related to compilers, Translation process, Major data structures, Other issues in compiler structure, Boot strapping and porting.

Lexical analysis: The role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical-Analyzer Generator Lex.

UNIT-II

Syntax Analysis: Introduction, Top-Down parsing, Bottom-Up parsing, Introduction to LR Parsing, More powerful LR parsers, Using Ambiguous Grammars, Parser Generators YACC.

UNIT-III

Syntax Directed Translation: Syntax Directed Definitions, Evaluation Orders for SDDs, Applications of Syntax Directed Translation.

Intermediate code generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow.

Symbol Table Organization: Structure of Symbol table, Symbol Table organization for Block Structured and non-Block Structured languages, Data Structures of symbol Table.

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UNIT-IV

Runtime Environments: Storage Organization, Stack Allocation of Space, Access to Non local Data on the Stack, Heap Management, Introduction to Garbage Collection.

Code Generation : Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Peephole Optimization, Register Allocation and Assignment.

UNIT-V

Machine Independent Optimizations: The Principal Sources of Optimizations, Introduction to data flow analysis, Foundation of data flow analysis.

Linkers and Loaders: Basic Loader functions, Design of an Absolute Loader, A simple bootstrap loader, Machine dependent and independent features.

Text Book:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman ,"Compilers: Principles, Techniques &Tools", Pearson Education, Second Edition, 2007.

Suggested Reading:

1. Leland L Bech, "System Software: An Introduction to Systems Programming", Pearson Education , Asia.
2. Kenneth C Louden, "Compiler Construction: Principles and Practice", Cengage Learning.

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IT 314

INFORMATION SECURITY

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To introduce students with basic concepts in information system and its relevance in modern society.
2. To understand several security requirements and operations - analysis, design, and implementation of the Security System Development Life Cycle (SecSDLC)
3. To understand and implement authentication, integrity and confidentiality along with related protocols.

Course Outcomes:

Students who complete the course should be

1. Aware of information security issues and understand its technologies.
2. Able to discover, analyse and deal with threads using advanced security issues and technologies.

Prerequisites:

Computer networks, Software Engineering.

UNIT- I

Introduction: History, critical characteristics of information, NSTISSC security model, Components of an information system, securing the components, balancing security and access, The SDLC, The security SDLC.

Need for Security: Business needs, Threats, Attacks-secure software development.

UNIT-II

Legal, Ethical and Professional Issues: Law and ethics in information security, relevant U.S laws-international laws and legal bodies, Ethics and information security.

Risk Management: Overview, Risk Identification, risk assessment, Risk Control strategies, selecting a risk control strategy, Quantitative versus qualitative risk control practices, Risk management discussion points, recommended risk control practices.

UNIT-III

Planning for Security: Security policy, Standards and practices, Security blue print, Security education, Continuity strategies.

Security Technology-Firewalls and VPNs: Physical design, firewalls,protecting remote connections.

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UNIT-IV

Security Technology-Intrusion detection: Access control and other security tools - Intrusion detection and prevention systems, Scanning and analysis tools, Biometric Access Controls.

Cryptography: Foundations of cryptology, cipher methods, cryptographic Algorithms, Cryptographic tools, Protocols for secure communications, Attacks on cryptosystems.

UNIT-V

Implementing Information Security: Information security project management, Technical topics of implementation, Non-technical aspects of implementation, Security certification and accreditation.

Security and Personnel: Positioning and staffing security function, Credentials of InformationSecurity Professionals, Internal control strategies.

Information security Maintenance: Security management models, TheSecurity maintenancemodel, Digital forensics.

Text book:

1. Michael E. Whitman and Hebert J Mattord, "Principles of Information Security", Fourth Edition, Cengage Learning 2011.

Suggesting Reading:

1. Thomas R Peltier, JustingPeltier, John Blackley, "Information Security Fundamentals", Auerbacj Publications 2010.
2. Detmar W Straub, Seymor Goodman, Richard L Baskerville, "Information Security Policy proceses and practices", PHI, 2008.
3. Marks Merkow and Jim Breithaupt, "Information Security Principle and Practices", Pearson Education, 2007.

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IT 315

OBJECT ORIENTED SYSTEM DEVELOPMENT USING UML

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Toacquaint the student with the precise vocabulary and powerful notation used in Unified modeling language.
2. To learnmethodology for analysis and design by using object oriented concepts.
3. To strengthen software development by lucrative UML diagrams.

Course Outcomes:

Students who complete this course should be able to

1. Understand the importance of systems analysis and design in solving complex problems.
2. Construct effective UML models for software development.

Prerequisites:

Basic Programming, OOPS Concepts, Software Engineering.

UNIT-I

UML Introduction: Why we Model, Introducing the UML, Elements of UML.Basic Structural Modeling: Classes, Relationships, Common Mechanisms, Diagrams, ClassDiagrams.

Advanced Structural Modeling: Advanced Classes, Advanced Relationships, Interfaces, Typesand Roles, Packages, Instances, Object Diagrams, Components, Case studies on class diagrams.

UNIT-II

Basic BehavioralModeling: Interactions, Use Cases, Use Case Diagrams, Interaction diagrams,Activity diagrams, Case studies on Use Case diagrams, Interaction diagrams.

Advanced BehavioralModeling: Events and Signals, State Machines, Processes and Threads, Time and space, State Chart Diagrams, Case studies on State chart diagrams.

UNIT-III

Architectural Modeling: Artifacts, Deployment Collaborations, Patterns and Frame-works,Artifact Diagrams, Deployment Diagrams, Systems and Models, Case studies on Deployment diagrams.

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UNIT-IV

Unified Software Development Process: The Unified Process, The Four Ps, A Use-Case DrivenProcess, An Architecture-Centric Processes, An Iterative and Incremental Process.

UNIT-V

Core Workflows: Requirements Capture, Capturing Requirements as Use Cases, Analysis,Design, Implementation, Test.

Text book:

1. Ivor Jacobson, Grady Booch, James Rumbaugh, “The Unified Software DevelopmentProcess”, Pearson Education, India, 2008.

Suggested Reading:

1. Grady Booch, James Rumbaugh, Ivor Jacobson, “The Unified Modeling Language-UserGuide(Covering UML 2.0)”, Second Edition, Pearson Education, India, 2007.
2. Martin Fowler, “UML Distilled”, Addison Wesley, Third Edition, 2003.

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With effect from the academic year 2015-16

CE 444 **HUMAN VALUES AND PROFESSIONAL ETHICS**

Instructions	: 21 Periods per semester (7*3)
Duration of University Examination	: 2 Hours
University Examination	: 50 Marks
Sessional	: Nil
Credits	: Nil

Course Objectives:

1. To develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. To enable the students understand the values, the need for value adoption and prepare them meet the challenges
3. To enable the students develop the potential to adopt values, develop a good character and personality and lead a happy life
4. To motivate the students practice the values in life and contribute for the society around them and for the development of the institutions /organisation around they are in.
5. To make the students understand the professional ethics and their applications to engineering profession

Course Outcomes

1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, convert everything into happiness and contribute for the happiness of others.
4. Students become potential sources for contributing to the development of the society around them and institutions / organisations they work in.
5. Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

UNIT-1 Concepts and Classification of Values –Need and challenges for value Adoption

Definition of Values – Concept of Values – Classification of Values – Hierarchy of Values – Types of Values –Espoused and Applied Values – Value judgement based on Culture – Value judgement based on Tradition – Interdependence of Values

Need for value education – Findings of Commissions and Committees - Corruption and illegal practices – Science and Technology without values- Exploitation of nature – Increasing use of violence and intoxicants – Lack of education in values – Implications of education in values – Vision for a better India

Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges

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UNIT – 2: Personal Development and Values in Life

Personal Development: Enlightened self-interest – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity – The quest for Character – Tests of Character – The key to good character

Values in Life: Building an ethical policy – Integrating values in everyday life – Archaic Social Values – Parenting practices – Critical Thinking - Analyzing and Prioritizing values – Practicing Yoga and Meditation

UNIT – 3: Practicing Values for the development of Society

Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atrocities – Environmental awareness – Working for the Sustainable development of the society

Values in Education system: Present Scenario- Engineering education –Current trends- Need for quality improvement- Adoption of value education – Principles of Integrity- Institutional Development.

UNIT – 4: Basic Concepts of Professional Ethics

Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional ethics, Ethical dilemmas, Indian and Global thoughts on ethics, Profession, Professional and Professionalism, Ethical role of a professional Basic ethical principles, Some basic ethical theories, use of ethical theories.

Science, Religion Ethics, Genders and ethics, Media and ethics, Computer Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities

UNIT-5: Ethics in engineering profession

Engineering profession-Technology and Society-Engineering as Social Experimentation-Engineering ethics-Ethical obligations of Engineering Professionals-Role of Engineers-Engineers as Managers-Professional responsibilities of Engineers- Engineers Responsibility for Safety- A few Case Studies on Risk management

Conflicts of Interest- Occupational Crimes- Plagiarism-Self plagiarism-Ethics Audit-Consideration for ethics audit-Ethics Standards and Bench Marking

Text Books:

1. Subramanian R., “ Professional Ethics “ , Oxford University Press , 2013
2. Nagarajan R.S., “ A Text Book on Human Values and Professional Ethics “ New Age Publications , 2007

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3. Dinesh Babu S., " Professional Ethics and Human Values", Laxmi Publications, 2007

Reference Books:

4. SantoshAjmera and Nanda Kishore Reddy " Ethics, Integrity and Aptitude",McGrawhill Education Private Limited , 2014
5. GovindaRajan M., Natarajan S., Senthil Kumar V.S." Professional Ethics and Human Values " Prentice Hall India Private Limited ,2012
6. Course Material for Post Graduate Diploma In "Value Education & Spirituality" Prepared by Annamalai University in Collaboration with Brahma Kumaris , 2010

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IT 316

OPERATING SYSTEMS LAB

Instruction per week	3 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:
1. To familiarize with various system calls of LINUX.
2. To implement processes synchronization and scheduling algorithms.
3. To develop a simulator of process set.

Course Outcomes:
Students who complete the course should be able to
1. Use system calls for managing inter-process communication.
2. Capable of simulating different processes sets.

Prerequisites:
Knowledge of C Programming, Basic commands of UNIX, Data Structures.

List of Programs

1. a. Create 2-processes using fork() system call of LINUX.
   b. Create processes hierarchy using fork() system call of LINUX.
2. a. Demonstrate execvp() system call for executing another inbuilt function.
   b. Demonstrate execvp() system call for executing user defined function.
3. Use system calls to get the attributes of a file/Directory.
4. Use system calls to get and set the environment variables.
5. a. Implement Echo server using pipes.
   b. Implement full duplex communication using pipes.
6. a. Implement Echo server using shared memory.
   b. Implement Client-Server model using shared memory.
7. a. Implement Echo server using Message queues.
   b. Implementprivate communication between a server and multiple clients via a single message queue.
8. a. Simulate FCFS CPU Scheduling Algorithm.
   b. Simulate SJF CPU Scheduling Algorithm.
9. Implement Banker's algorithm for Deadlock Avoidance.
10. Implement Producer-Consumer Problem using Message passing.
11. Implement Dining philosophers problem using semaphores.
12. Implement Producer-Consumer Problem using semaphores.
13. Implement Reader-writers problem using Semaphores.

Suggested Reading:

1. W. Richard Stevens, "Unix Network Programming", Volume 1, Addison-Wesley Professional, 2004.

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IT 317

DATABASE LAB

Instructionper week	3 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	50 Marks
Sessional	25 Marks
Credits	2

Course objectives:

1. To present the concepts and techniques relating to query processing.
2. To design and develop database for an application.
3. To understand various methods of securing the database.

Course outcomes:

Students who complete this course should be able to

1. Design and implement a database schema by enforcing integrity constraints for a given problem-domain.
2. Populate and query a database using SQL DML/DDL commands.
3. Do PL/SQL programming.

Prerequisites:

Familiarity with variables and data types is required.

List of Programs

1. Creation of database (exercising the commands for creation).
2. Exercising Simple to complex queries.
3. Demonstration of PL/SQL Blocks, Procedures and Functions.
4. Usage of Triggers and Cursors.
5. Demonstrate Exception Handling by PL/SQL procedures for data validation.
6. Creation of Forms for student Information, library information etc.
7. Generation using SQL reports.
8. Creating Password and Security features for applications.
9. Usage of File locking table locking, facilities in applications.
10. Creation of small full pledged database application spreading over to 3 sessions.

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

Suggested Reading:

1. Rick F Vander Lans, “Introduction to SQL”, Fourth edition, Pearson Education,2007.
2. Benjamin Rosenzweig, Elena Silvestrova, “Oracle PL/SQL by Example”, Third Edition, Pearson Education, 2004.
3. Albert Lulushi, “Oracle Forms Developer’s Handbook”, Pearson Education, 2006.

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With effect from the academic year 2015-16

IT 318

MINI PROJECT – III

Instruction per week	3 Periods
Sessional	25
MarksCredits	1

The Students are required to carry out Mini Project in any of the areas such as DatabaseSystems, Operating Systems,Compiler Design and Object Oriented System Development.

Students are required to submit a report on the Mini Project at the end of the Semester.

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EG 221

SOFT SKILLS AND EMPLOYABILITY ENHANCEMENT

Instructionper week	2 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	50 Marks
Sessional	25 Marks
Credits	1

Course Objectives: To help the students

1. Participate in group discussions with confidence and to make effective presentations. Also to learn the art of communication.
2. With- resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management & goal setting, self-confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.

Course Outcomes: The students will be able to

1. Be effective communicators and participate in group discussions 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 mange 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.

List of Experiments

Exercise 1

Communicative Competence – The Art of Communication, basic grammar, Indianisms, Effective listening skills, using English in different situations

Exercise 2

Group Discussion – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence

Elements of effective presentation – Structure of presentation – Presentation tools – Body language

Creating an effective PPT

Exercise 3

Interview Skills – Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets

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Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

Exercise 4

Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.

Exercise 5

Corporate Culture – Grooming and etiquette, communication media etiquette
Academic ethics and integrity

Suggested Reading:

1. Madhavi Apte , “A Course in English communication”, Prentice-Hall of India, 2007
2. Leena Sen , “Communication Skills”, Prentice-Hall of India, 2005
3. Dr. Shalini Verma, “Body Language- Your Success Mantra”, S Chand, 2006
4. Edgar Thorpe and Showick Thorpe , “Objective English”, 2nd edition, Pearson Education, 2007
5. Ramesh, Gopalswamy, and Mahadevan Ramesh, “The ACE of Soft Skills”, New Delhi: Pearson, 2010
6. Gulati and Sarvesh, “ Corporate Soft Skills”, New Delhi: Rupa and Co. , 2006
7. Van Emden, Joan, and Lucinda Becker, “Presentation Skills for Students”, New York: Palgrave Macmillan, 2004
8. Covey and Stephen R, “The Habits of Highly Effective People”, New York: Free Press, 1989

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IT 356 Human Computer Interaction

With effect from the academic year 2015-16

IT 321

COMPUTER NETWORKS AND SOCKET PROGRAMMING

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To understand the fundamental concepts of computer networks and Socket programming.
2. To know the role of various layers and protocols for computer networks.
3. To introduce internet services and security policies.

Course Outcomes:

Students who complete this course should be able to

1. Identify the different types of network topologies and protocols, networking devices and their functions within the network.
2. Enumerate the layers of the OSI model and TCP/IP and describe the function(s) of each layer.
3. Develop solutions for networking and security problems, balancing business concerns, technical issues and security.

Prerequisites:

Structured Programming, Data Communications.

UNI T-I

Introduction: Uses of Computer Networks, Network Hardware, Network Software: Reference Models (ISO -OSI, TCP/IP).

Network Programming: Socket Interface: Sockets, Socket Address, Elementary Sockets, Advanced Sockets, Socket Options, Out of Band Data, Daemon process and Internet Super Server.

Remote Procedure Calls: Introduction, Transparency Issues and Sun RPC.

UNI T-II

Network Layer: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, Quality of Service.

Internetworking: Concatenated virtual circuits, Connectionless Internetworking, Tunneling,Internetworkrouting, Fragmentation.

UNIT-III

Network layer in the Internet: Internet Protocol, IPv4, IPv6, Interoperability of IPv4 and IPv6, IP addresses, Internet Control protocols, OSPF, BGP, Internet Multicasting, Mobile IP.

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Transport Layer: The Transport Service, Elements of Transport Protocols, The Internet **Transport Protocols:** UDP, Internet Transport Protocols - TCP.

UNIT-IV

Application Layer: Domain Name System:DNS Name Space, Resource Records, Name Servers.

Electronic Mail: Architecture and Services, UserAgent, Message Formats, Message transfer and Final Delivery.

World Wide Web: Architectural Overview, Static Web Documents, Dynamic Web Documents, HTTP, Wireless Web.

Multimedia: Digital Audio, Streaming Audio, Voice over IP, Video on Demand.

UNIT-V

Network Security: Cryptography, Symmetric Key Algorithms, Public Key Algorithms, Digital Signatures, Management of Public Keys, Communication Security, Authentication Protocols, E-mail Security, Web Security.

Text Book:

1. Andrew S. Tanenbaum, "Computer Networks", Fourth Edition, Pearson Education.
2. W. Richard Stevens, "Unix Network Programming" Prentice Hall/Pearson Education,2009.

Suggested Reading:

1. James F. Kurose, Keith W, Ross, "Computer Networking, ATop-Down Approach Featuring the Internet", Third Edition, Pearson Education, 2005.
2. William Stallings, "Computer Networking with Internet Protocols and Technology", Pearson Education, 2004.

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IT 322

DATA WAREHOUSING AND DATA MINING

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 MarksCredits
	3

Course Objectives:

1. To introduce the basic concepts of Data Warehouse and Data Mining techniques.
2. Examine the types of the data to be mined and apply preprocessing methods on raw data.
3. Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

Course Outcomes:

Students who complete this course should be able to

1. Process raw data to make it suitable for various data mining algorithms.
2. Discover and measure interesting patterns from different kinds of databases.
3. Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.

Prerequisites:

Basic Programming, Mathematics-Statistics, Database Concepts

UNIT-I

Introduction: Introduction to Data Mining, Data Mining Functionalities, Classification of Data Mining Systems, 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, DataCleaning, DataIntegration, DataReduction, Data Transformation and Data Discretization.

UNIT-II

DataWarehousing and Online Analytical Processing

DataWarehouse: Basic Concepts, DataWarehouseModeling: Data Cube and OLAP, DataWarehouse Design and Usage: A Business Analysis Framework for Data Warehouse Design, Data Warehouse Design Process, Data Warehouse Usage for Information Processing, DataWarehouse Implementation.

Mining Frequent Patterns,Associations and correlations: Basic Concepts, Frequent Item Set Mining Methods, Interesting patterns, Pattern Evaluation Methods, Pattern Mining in Multilevel and multidimensional space.

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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 and AdaBoost.

Classification: Advanced Methods

Bayesian Belief Networks, Classification by Back propagation, Support Vector Machines, Lazy Learners (or Learning from Your Neighbors), Other Classification Methods.

UNIT-IV

Cluster Analysis: Basic Concepts and Methods, Overview of Basic Clustering Methods,Partitioning Methods, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, BIRCH: Multiphase Hierarchical Clustering Using Clustering Feature Trees.

Density-Based Methods: DBSCAN: Density-Based Clustering Based on Connected Regions with High Density, OPTICS: Ordering Points to Identify the Clustering Structure, Grid-Based Methods.

Evaluation of Clustering: Assessing Clustering Tendency, Determining the Number of Clusters, Measuring Clustering Quality.

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: Time-Series, Symbolic Sequences and Biological Sequences, Mining Other Kinds of Data, Data Mining Applications, Data Mining and Society, Data Mining Trends.

Text Book:

1. Han J &Kamber M, “Data Mining: Concepts and Techniques”, Third Edition, Elsevier, 2011.

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 andImplementation”, 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.

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IT 323

WEB PROGRAMMING

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To design and develop web pages using html5, CSS positioning, servlets and JDBC.
2. Understanding and writing a well-formed XML schemas and documents.
3. Using JSP as view component in MVC based web applications.
4. Understanding .NET architecture and writing applications with ADO.NET

Course Outcomes:

Students who complete this course should be able to

1. Design and develop various web based applications using JavaScript and servlets
2. Use JDBC in JSP pages, Create web forms with JQuery.
3. Design web site using HTML, CSS and ASP.NET with Ajax based requests.

UNIT-I

Introduction: Web Fundamentals, **HTML 5.0:** basic tags, Form elements and attributes.
Introduction to Cascading Style Sheets: CSS selectors, CSS BOX Model, CSS Positioning, and CSS floating.
JQuery: Introduction to JavaScript, Selecting elements in the documents, Event handling, working with styles, The Event object, Using and creating plugins, JSON Fundamentals.
Web-Based and REST Style Services:

UNIT-II

Introduction to XML: The Syntax of XML, XML Document Structure, Document Type Definitions, Name Space, XML Schemas, Displaying raw XML Documents, Displaying XML Documents with CSS, XSLT Style Sheets and XML Processors.

UNIT-III

Java Servlets: Servlet Life Cycle,Basic Servlet Structure, request methods, passing initialization parameters from web.xml, Handling the client request form data, Generating HTTP Response, Request dispatching and State Management techniques.
Java Server Pages: Expressions, Scripting elements, Page Directives, Actions, JSP Objects, Handling Exceptions, MVC Flow of Control, Accessing MsAccess, MySQL and Oracle databases using servlets and JSP.

UNIT-IV

Web Services: Definition, Web services Architecture, Simple Object Access Protocol

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(SOAP) - goals, structure and contents of a SOAP Message, processing a SOAP message, Web Services Description language (WSDL) - Structure of WSDL interface, Implications of WSDL Model, Universal description discovery and integration (UDDI) - Goals, Information in a UDDI registry, UDDI data structures, UDDI Registry API.

UNIT-V

ASP.NET: Web Form fundamentals, Web Controls, State management, Building better web form - Validation, rich controls, user controls and graphics, Data Management with ADO.NET, ASP.NET with Ajax.

Text Book:

1. Robert W.Sebesta, "Programming with World Wide Web", Eighth Edition, Pearson Education, 2008.
2. John Pollak, "JQuery - A Beginners Guide", McGraw-Hill Education, 2014.
3. Phil Hanna, "The Complete Reference JSP", First Edition, Tata McGraw-Hill, 2003.
4. Gustavo Alonso ,"Web Services: Concepts, Architectures and Applications" Springer Science & Business Media, 2004
5. Matthew MacDonald, "Beginning ASP.NET 4.5 in C#", Illustrated, Apress, 2012.

Suggested Reading:

1. James Webber, SavasParastatidis, Ivan Robinson,"Rest in Practice:HyperMedid and System Architecture", First Edition,O'REILLY,2010.

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IT 324

COMPUTATIONAL INTELLIGENCE

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:
1. To understand knowledge representation and logical reasoning techniques used in Artificial Intelligence.
2. To learn problem solving techniques, natural language processing and build expert systems.
3. To design machine learning and neural network systems.

Course Outcomes:
Students who complete this course should be able to
1. Design an Expert System to solve real world problems.
2. Develop self-learning system that can compensate for partial knowledge base.

Prerequisites:
Discrete Mathematics, Probability and Random Theory.

UNIT-I
Introduction: History, Intelligent Systems, Foundations of AI, Sub areas of AI, 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 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.

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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, Certainty Factor Theory, Dempster-Shafer Theory.

UNIT-IV

Machine-Learning Paradigms: Introduction, Machine Learning Systems, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees, Deductive Learning. Clustering, Support Vector Machines.

Artificial Neural Networks: Introduction, Artificial Neural Networks, Single-Layer Feed-Forward Networks, Multi-Layer Feed-Forward Networks, Radial-Basis Function Networks, Design Issues of Artificial Neural Networks, Recurrent Networks.

UNIT-V

Advanced Knowledge Representation Techniques: Case Grammars, Semantic Web.

Natural Language Processing: Introduction, Sentence Analysis Phases, Grammars and Parsers, Types of Parsers, Semantic Analysis, Universal Networking Knowledge.

Text books:

1. SarojKaushik, “Artificial Intelligence”, Cengage Learning, 2011.
2. Tom M. Mitchell, “Machine Learning”, McGraw Hill, 1997.
3. Kulkarni, Parag, Joshi, Prachi ,”Artificial Intelligence : Building Intelligent Systems”,PHI,2015

Suggested Reading:

1. Russell, Norvig, “Artificial intelligence - A Modern Approach”, Pearson Education, Second Edition. 2004.
2. Rich, Knight, Nair: “Artificial intelligence”, Tata McGraw Hill, Third Edition 2009.
3. Nilsson, N., “Artificial Intelligence: A New Synthesis”, San Francisco, Morgan Kaufmann, 1998.
4. Peter Jackson, “Introduction to Expert Systems”, Third Edition, Pearson Addison Wesley,1998

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IT 325

DIGITAL IMAGE PROCESSING AND ANALYSIS

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To learn the fundamental concepts and applications of digital image processing.
2. To learn the image processing concepts: Intensity transformations, spatial filtering, smoothing and sharpening in both spatial and frequency domains, Image restoration and reconstruction, Color image processing, Image compression.
3. To learn the image analysis concepts: morphological image processing, image segmentation, image representation and description, and object recognition.

Course Outcomes:

Students who complete this course should be able to

1. Implement Pre and Post process for the given image using image enhancement techniques.
2. Design and Implement digital image processing related problems as part of mini projects.
3. Implement Color image processing and Image compression methods.

Prerequisites:

Knowledge of linear algebra, basic probability and statistics.

UNIT-I

Basics: Introduction, Fundamental steps, Components, Elements of visual perception, image sampling and quantization, some basic relationships between pixels.

Intensity Transformations: Some Basic Intensity Transformation Functions, Histogram Processing.

UNIT- II

Spatial Filtering: Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

Filtering in the Frequency Domain: Preliminary Concepts, Image Smoothing using Frequency Domain Filters, Image Sharpening Using Frequency Domain Filters.

UNIT- III

Image Restoration and Reconstruction: A Model of the Image degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only - Spatial Filtering, Minimum Mean Square Error (Wiener) Filtering.

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing.

UNIT- IV

Image Segmentation: Fundamentals, Point, Line, and Edge Detection, Segmentation by Thresholding, Region-Based Segmentation, Segmentation Using Watershed Algorithm.

Representation and Description: Representation, Some Simple Descriptors, Shape Numbers, Fourier Descriptors.

Object Recognition: Patterns and Pattern Classes, Matching: Minimum distance classifier, correlation.

UNIT-V

Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing.

Image Compression: Fundamentals, Compression Techniques, Lossless Compression, Lossy Compression, Measuring Information, Huffman Encoding, Arithmetic Coding, LZW, Run Length, Predictive Coding.

Text Book:

1. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing", Pearson Education, Third Edition.

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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IT 351

COMPUTER GRAPHICS

(ELECTIVE – I)

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Acquire knowledge about device level algorithms for displaying two dimensional output primitives for raster graphics system.
2. Acquire knowledge about the basic concepts of representing 3D objects in 2D.
3. To introduce computer graphics techniques transformations, clipping, curves and surfaces.

Course Outcomes:

Students who complete this course should be able to

1. Understand the core concepts of computer graphics.
2. Understand graphics techniques for rasterization, clipping, curve generation etc.
3. Represent pictures using various algorithms.

Prerequisites:

Knowledge of Linear Algebra (vectors and matrices), Good programming skills.

UNIT-I

Computer Graphics: Introduction, Application areas, Overview of graphics systems: Video-display devices, Raster-scan systems, Random scan systems, Graphics monitors and Work stations and input devices, Graphics software.

Output primitives: Points and lines, line drawing algorithms: DDA and Bresenham's line generation, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms, Fill-Area Functions, Cell Array, Character generation.

UNIT-II

Attributes of Output Primitives: Line Attributes, Curve Attributes, color and gray scale levels, Area Fill Attributes, Character Attributes, Bundled Attributes, Inquiry Functions.

Structures and Hierarchical Modeling: Structure concepts, Editing Structures, Hierarchical modeling with structures. Graphical User Interfaces and Interactive Input Methods: The User Dialogue, Logical Classification of Input Devices, Input Functions, Interactive Picture Construction Techniques.

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UNIT-III

2-D Geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.

2-D Viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Liang-Barsky line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

UNIT-IV

3-D Object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-spline curves, Bezier and B-spline surfaces, CSG, Octrees, BSP Trees.

3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations, 3-D viewing: Viewing pipeline, viewing coordinates, projections, view volume and general projection transforms.

UNIT-V

Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods.

Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.

Text Book:

1. Donald Hearn and M.Pauline Baker, "Computer Graphics C version", Second Edition, Pearson Education.

Suggested Reading:

1. Foley, VanDam, Feiner and Hughes, "Computer Graphics Principles & Practice in C", Second edition, Pearson Education.
2. David F Rogers, "Procedural elements for Computer Graphics", Tata McGraw Hill, Second Edition.
3. Neuman and Sproul, "Principles of Interactive Computer Graphics", Tata McGraw Hill.
4. Shalini, Govil-pai, "Principles of computer Graphics", Springer.

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IT 352

SOFTWARE TESTING
(ELECTIVE – I)

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To learn various software testing techniques through case studies.
2. To understand the essential characteristics of various automation tools used for testing.

Course Outcomes:

Students who complete this course should be able to

1. Apply various test processes and use various testing tools.
2. Implement methods of test generation from requirements.

Prerequisites

Object Oriented Analysis and Design with UML, Software Engineering.

UNIT-I

Introduction: SoftwareTesting, Goals of Software Testing, Software Testing Definitions, Effective Software Testing Vs Exhaustive Software Testing, Software Testing Life Cycle, Software Testing Methodology, Verification and Validation – Verification of Requirements, High Level design, Low level design.

UNIT-II

Dynamic Testing: Black Box Testing Techniques-Functional Testing, Equivalence partitioning, BVA.White Box Testing Techniques-Structural Testing, Static Testing, Validation Activities, Regression Testing. .

UNIT-III

Test Management, Testing Metrics-Base Metrics, Calculated metrics, Manual vs Automated testing, Efficient Test Suite Management.

UNIT-IV

Testing Object Oriented Software – OOT Basics, Object Oriented testing, Testing Web based systems,- Web based system, Web Technology Evolution, Challenges in testing for web bases software, Quality Aspects, Web Engineering (Webe), Testing of Web based systems.

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UNIT-V

Overview of Testing Tools, Testing an Application using WinRunner, Test Script Language, Selenium software testing tool, Use of LoadRunner and Rational functional tester, Junit, Source Code Testing Utilities in Unix / Unix Environment.

Text Book:

1. NareshChauhan, “Software Testing Principles and Practices”, Oxford University Press, 2010.
2. Dr.K.V.K.K.Prasad, “Software Testing Tools”, Dreamtech press, 2008.

Suggested Reading:

1. William E. Perry, “Effective Methods for Software Testing”,Third Edition, Wiley & Sons, 2006.
2. SrinivasanDesikan, Gopalaswamy Ramesh, “Software Testing: Principles and Practices”, Pearson Education, 2006.

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IT 353

SOFTWARE PROJECT MANAGEMENT
(ELECTIVE-I)

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:
1. To plan and manage projects at each stage of SDLC.
2. To understand the basic concepts and issues of Software Project Management.
3. To discuss the notion of Process Improvement and Process Management.

Course Outcomes:
Students who complete this course should be able to
1. Choose most effective software development model to suit organizational needs.
2. Plan and implement the software projects.
3. Improve process and manage project profiles.

Prerequisites:
Software engineering

UNIT - I
Conventional Software Management, Evolution of Software Economics, Improving SoftwareEconomics, Old Way & New.

UNIT - II
Life - Cycle Phases, Artifacts of the Process, Model Based Software Architectures, Workflows of the Process, Checkpoints of the process.

UNIT - III
Iterative Process Planning, Project Organization & Responsibilities, Process Automation, Project Control and Process Instrumentation, Tailoring the Process.

UNIT - IV
Modern Project Profiles, Next Generation Software Economics, Modern Process Transitions, Managing Contacts, Managing People & Organizing Terms.

UNIT - V
Process Improvement & Managing to the CMM, ISO 12207- an Overview, Programme Management.

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Text Book:

1. Walker Royce, "Software Project Management - A Unified frame work", Pearson Education, Addision Wesley.

Suggested Reading:

1. Bob Hughes, MilkeCotterell- "Software Project Management", Tata McGraw Hill, Third Edition.
2. Watt S. Humphery, "Managing Software Process", Addison Wesley, 1998.

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IT 354

NATURAL LANGUAGE PROCESSING
(ELECTIVE-I)

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:
1. To understand the applications of NLP and different levels of language analysis.
2. To understand syntax and semantics of the language and knowledge representations.
3. To understand the basic concepts of NLP including PoS tagging, Word senses and Ambiguity and to encode ambiguity in logical form.
4. Understand machine learning techniques used in NLP including statistical methods and probabilistic context-free grammars.

Course Outcomes:
Students who complete this course should be able to
1. Understand and apply relevant linguistic concepts and Machine Learning techniques.
2. Choose appropriate solutions for solving typical NLP sub problems (tokenizing, tagging, parsing).
3. Formulate NLP tasks as learning and inference tasks, and address the computational challenges involved.

UNIT- I
Introduction to Natural Language Processing: The study of Language, Applications of NLP, EvaluatingLanguage Understanding Systems, Different levels of Language Analysis,Representations and Understanding, Organization of Natural language, Understanding Systems.

UNIT-II
Linguistic Background: An outline of English syntax,Spoken Language input and output Technologies, Written language Input - Mathematical Methods - statistical Modelling and classification Finite StateMethods.Grammar for Natural Language Processing - Parsing - Introduction to semantics and knowledge representation, Some applicationslike Machine translation, database interface.

UNIT-III
Grammars and Parsing: Grammars and sentence Structure, Top-Down andBottom-Up Parsers, Transition Network Grammars, Top-Down ChartParsing.

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Feature Systems and Augmented Grammars: Basic Feature systemfor English, Morphological Analysis and the Lexicon, Parsing with Features,Augmented Transition Networks.

UNIT-IV

Semantic Interpretation: Semantics and Logical Form,word senses and ambiguity, The Basic logical formlanguage, Encoding ambiguity in logical form, Thematic roles, Linking syntaxand semantics, Recent trends in NLP.

UNIT-V

Ambiguity Resolution: Statistical Methods, Probabilistic LanguageProcessing, Estimating Probabilities, Part-of-Speech tagging, ObtainingLexical Probabilities, Probabilistic Context-Free Grammars, Best FirstParsing.

Text Book:

1. James Allen, “Natural Language Understanding”, Pearson Education, Second Edition

Suggested Reading:

1. Christopher D Manning and HinrichSchutze, “Foundations of Statistical Natural Language Processing”, MIT Press, 1999.
2. AksharBharti, VineetChaitanya and Rajeev Sangal, “NLP: A Paninian Perspective”, Prentice Hall, New Delhi.
3. D. Jurafsky, J. H. Martin, “Speech and Language Processing”, Pearson Education.

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IT 355

ADVANCED COMPUTER ARCHITECTURE
(ELECTIVE-I)

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To understand the concepts of Modern processor design.
2. To understand the concepts of Pipelining and Instruction level parallelism.
3. To understand the concepts of Vector Processors and Array Processors.

Course Outcomes:

Students who complete this course should be able to

1. Analyze, evaluate CPU and memory performance.
2. Understand trade-offs in modern CPU design including issues affecting superscalar architectures.
3. Analyze hardware design of multiprocessors including cache coherence and synchronization.

Prerequisites:

Computer organization

UNIT- I

Measuring Performance and Cost: Performance Measurement, Enhancement to Uniprocessor, Models, Benchmarks, Basic Model of Advanced Computer Architectures.

UNIT- II

Pipelining and Superscalar Techniques: Basic Pipelining, Data and Control Hazards, Dynamic Instruction Scheduling, Branch Prediction Techniques, Performance Evaluation, Case Study-Sun Microsystems – Microprocessor.

UNIT- III

Vector Processors: Vector Processor Models, Vector Architecture and Design, Performance Evaluation, Programming Vector Processors.

UNIT- IV

Array Processors: Parallel Array Processor Model, Memory Organization,
Interconnection Networks: Performance Measures, Static and Dynamic Topologies.

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UNIT-V

Multiprocessors and Multi Computers: Multiprocessor Models, Shared –Memory and Distributed Memory Architectures, Memory Organization, Cache Coherence and Synchronization Mechanisms, Parallel Computer, Performance Models.

Text Book:

1. John. L. Hennessey and David A Patterson, "Computer Architecture - A Quantitative Approach", Fourth Edition, Elsevier, 2007.

Suggested Reading:

1. Sajjan G. Shiva, Taylor Series, "Advanced Computer Architecture", CRC Press, 2006.
2. Kai Hwang, "Advanced Computer Architecture", McGraw Hill, 1999.

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IT 356

HUMAN COMPUTER INTERACTION
(ELECTIVE-I)

Instruction per week	4 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To understand the need for optimizing the user's interactions with a system, environment or product, so that they match the users' activities that are being supported and extended.
2. To learn the characteristics of graphical and web user interface, the design and evaluation processes.
3. To develop knowledge of the structure and the representational dynamics of the cognitive system interacting with the computer.

Course Outcomes:

Students who complete this course should be able to

1. Demonstrate an understanding of guidelines, principles, and theories influencing human computer interaction.
2. Recognize how a computer system may be modified to cater to the diversity and cognition levels of people.
3. Carry out the steps of design, usability, experimental testing, and evaluation of human computer interaction systems.

Prerequisites:

Moderate experience using computers and GUI-based applications.

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

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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 and 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 modelling users.**

Text Book:

1. Wilbert O. Galitz, “The essential guide to User Interface Design”, Wiley Dreamtech, 2002.

Suggested Reading:

1. Sharp, Rogers, Preece, “Interaction Design”, Second Edition, John Wiley, 2008.
2. Steven Hein, “The Resonant Interface : HCI Foundations for Interaction Design”, Addison-Wesley,2007
3. J.Preece, Y.Rogers, and H.Sharp, “Interaction Design: Beyond Human-Computer Interaction”,Wiley& sons ,Second edition, 2007.

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IT 326

NETWORK PROGRAMMING LAB

Instruction per week	3 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. To understand the use of client/server architecture in application development.
2. To understand and use elementary socket system calls, advanced socket system calls and Java Socket API.
3. To understand how to use TCP and UDP based sockets.
4. To implement network routing algorithms, application layer protocols and encryption algorithms.

Course Outcomes:

Students who complete this course should be able to

1. Use network programming concepts to develop and implement distributed applications.
2. Develop and implement next generation protocols required for emerging applications.
3. Model and evaluate performance of networking systems.

Prerequisites:

Knowledge of C Programming, Basic commands of UNIX.

List of Programs

1. Understanding and using of commands like ifconfig, netstat, ping, arp, telnet, ftp, finger, traceroute, whoisetc. Usage of elementary socket system calls (socket(), bind(), listen(), accept(),connect(),send(),recv(),sendto(),recvfrom()).
2. Implementation of Connection oriented concurrent service (TCP).
3. Implementation of Connectionless Iterative time service (UDP).
4. Implementation of Select system call.
5. Implementation of gesockopt(),setsockopt() system calls.
6. Implementation of getpeername() system call.
7. Implementation of remote command execution using socket system calls.
8. Implementation of Distance Vector Routing Algorithm.
9. Implementation of SMTP.
10. Implementation of FTP.
11. Implementation of HTTP.
12. Implementation of RSA algorithm.

Note: Implement programs 2 to 7 in C and 8 to 12 in JAVA.

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Suggested Reading:

1. W. Richard Stevens, “Unix Network Programming”, Prentice Hall, Pearson Education,2009.
2. Douglas E.Comer,“Hands-on Networking with Internet Technologies”, Pearson Education.

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IT 327

DATA MINING LAB

Instruction per week	3 Periods
Duration of End - Semester Examination	3 Hours
End - Semester Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. Acquaintance to WEKA tool.
2. Prepare the data for mining and apply various mining techniques to analyse the data.
3. Design and develop datamining application on sample/realistic data sets.

Course Outcomes:

Students who complete this course should be

1. Competent to preprocess the data for mining.
2. Proficient in generating association rules.
3. Able to build various classification modelsand Realise clusters from the available data.

Prerequisites:

Database systems.

List of Programs

1. BasicsofWEKA tool
   a. Investigate the Application interfaces. b. Explore the default datasets.
2. Pre-process agiven dataset based on the following:
   a. Attribute Selection b.Handling Missing Values
   c. Discretization d. Eliminating Outliers
3. Create a dataset in ARFF (Attribute-Relation File Format) for any given dataset and perform Market-Basket Analysis.
4. Generate Association Rules using the Apriori algorithm.
5. Generate Association Rules using the FP-Growth algorithm.
6. Build a classifier using K-NN algorithm.
7. Build a Decision Tree by using J48 algorithm.
8. Cluster the IRIS dataset by using the k-Means Clustering algorithm and visualize the cluster mean values and standard deviation of dataset attributes.
9. Build various Regression models.
10. Explore various other data mining tools.

(Note: Wherever necessary interpret the results and measure the performance)

SuggestedReading

1. Ian H.Witten, Eibe Fank, Mark A Hall, "Data Mining Practical Machine Learning Tools and Techniques", Third edition, 2011.
2. Han and Kamber,"Data Mining Concepts and Techniques", Third Edition, Elsevier.

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IT 328

MINI PROJECT – IV

Instruction per week	3 Periods
Sessional	25 Marks
Credits	1

The Students are required to carry out Mini Project in any of the areas such as Computer Networks, Computational Intelligence, Digital Image Processing, Data Mining and Web Development.

Students are required to submit a report on the Mini Project at the end of the Semester.

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IT 411

BIG DATA ANALYTICS

Instruction	4 L / 1T periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites:
Data Structures, Design and Analysis of Algorithms, Database Systems, Data Warehousing and Data Mining.

Course Objectives:
1. To introduce the concepts and challenges of big data, role of HDFS in handling big data and MapReduce Architecture.
2. To explore mapper and reducer to solve real world problems.
3. To introduce the features of NoSQL and study the working mechanisms of MongoDB
4. To impart knowledge to work with semi structured and unstructured data using Pig
5. To familiarise with features of Hive to process and query big data

Course Outcomes:
Upon successful completion of this course, student will be able to
1. Develop framework for handling Big Data using Hadoop
2. Acquire, Store and analyse big data in business environments using HDFS
3. Develop programs in MapReduce to solve real world problems
4. Model data using MongoDB
5. Handle semi structured and unstructured big data using Pig
6. Process and query big data in HDFS environment using Hive

Unit - I
What is Big Data?, Why is Big Data Important: When to consider a Big data solution, Big Data use cases: IT for IT Log Analytics, The Fraud Detection Pattern, 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 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, Coherency Model, Parallel Copying with distcp, Keeping an HDFS Cluster Balanced

Unit - II
MapReduce: A Weather Dataset, Data Format, Analyzing the Data with Hadoop, Map and Reduce, Java MapReduce, Scaling Out, Data Flow, Combiner Functions, Running a Distributed MapReduce Job

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Developing a MapReduce Application: Writing a Unit Test with MRUnit, Mapper, Reducer, Running Locally on Test Data, Running a Job in a Local Job Runner, Testing the Driver, Running on a Cluster, Packaging a Job, Launching a Job, The MapReduce Web

Unit – III

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

Unit – IV

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 Modelling, Create Database, Drop Database, Create collection, Drop collection, Data types, Insert, Query, Update and Delete operations, Limiting and Sorting records, Indexing, Aggregation

Unit - V

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.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media Inc, 2015.
2. Paul C. Zikopoulos, Chris Eaton, Dirk DeRoos, Thomas Deutsch, George Lapis, "Understanding Big Data - Analytics for Enterprise class Hadoop and Streaming Data", McGrawHill, 2012.
3. Kristina Chodorow, “MongoDB: The Definitive Guide-Powerful and Scalable Data Storage”, 2nd Edition, O'Reilly Media, 2013

Suggested Reading:

1. Chuck Lam, Mark Davis, AjitGaddam, “Hadoop in Action”, Manning Publications Company, 2016.
2. Alex Holmes,” Hadoop in Practice”, Manning Publications Company, 2012.
3. Alan Gates, "Programming Pig", O'Reilly Media Inc, 2011.
4. Edward Capriolo, Dean Wampler, and Jason Rutherglen, "Programming Hive", O'Reilly Media Inc, October 2012.
5. Vignesh Prajapati, "Big data Analytics with R and Hadoop", Packt Publishing, November 2013.

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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IT 412

MOBILE COMPUTING

Instruction	4 L periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites: Data Communication, Computer Networks

Course Objectives:

1. To introduce cellular concepts, medium access mechanisms and features of a range of mobile devices and systems
2. To familiarize with the functions of network and transport layers for mobile networks
3. To provide an understanding of different techniques to handle databases, data dissemination and data Synchronization in Mobile Computing environments.

Course Outcomes:

Upon successful completion of the course, student will be able to

1. Explain 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. Appreciate the evolution in mobile system standards
4. Understand Mobile IP, packet delivery and Dynamic Host Configuration Protocol
5. Analyze different variations of TCP for mobile communication systems.
6. Describe database hoarding techniques, data dissemination and data Synchronization on mobile computing systems

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.

Medium Access Control: Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SDMA, FDMA, TDMA: Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access.

UNIT-II

Mobile Devices And Systems-Features of Mobile Smart Phones,Digital Music Players, Hand-held Pocket Computers, Operating Systems of Hand-held Devices and their features, Smart Systems- Smart cards, Smart labels, RFID, Smart Tokens, Sensors and Actuators, Set-top Boxes,Limitations of Mobile Devices,Automotive Systems.

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GSM: Mobile services, System architecture, Localization, Call Handling, Handover, Security, New data services.

Features of HSPA 3G Network, HSPA+, Long Term Evolution (LTE), WiMax and 4G LTE Advanced and WiMax 802.16m Networks.

UNIT-III

Mobile Network Layer: Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation, Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol.

UNIT-IV

Mobile Transport Layer : Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/timeout freezing, Selective retransmission, Transaction oriented TCP .

UNIT-V

Databases and Mobile Computing: Data Hoarding Techniques, Data Caching-Cache Invalidation Mechanisms, Data Cache Maintenance and Web Cache Maintenance in Mobile Environments, Power-aware Mobile Computing, Context-aware Computing.

Data Dissemination: Communication Asymmetry, Classification of Data Delivery mechanisms: Push-based mechanisms, Pull-based mechanisms, Hybrid mechanisms.

Data Synchronization: Synchronization in Mobile Computing Systems, Usage Models for Synchronization, Domain-dependent Specific rules for Data Synchronization, Personal Information Manager (PIM), Synchronization and Conflict resolution strategies, Synchronizer.

Text Books:

1. Jochen, M Schiller, “Mobile Communications”, 2nd Edition Pearson Education, India, 2012.
2. Raj Kamal, “Mobile Computing”, Second Edition, Oxford University Press, 2013.

Suggested Reading:

1. Reza B, “Mobile Computing Principles”, Cambridge University press 2005.
2. Frank Adelstein, S.K.S. Gupta, Golden G. Richard III and Loren Schwiebert, “Fundamentals of Mobile and Pervasive Computing”, McGraw-Hill Professional Publication.
2. KurnkumGarg, “Mobile Computing”, Pearson Education, 2010.
3. K. Pahlavan and P. Krishnamurthy, “Principles of Wireless Networks”, Prentice Hall.
4. D.P. Agrawal and Q.A. Zeng, “Introduction to Wireless and Mobile Systems”, Thomson Brooks/Cole.

IT 413

DISTRIBUTED SYSTEMS

Instruction	4 L periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites
Operating Systems, Computer Networks

Course Objectives:
1. To present the basic concepts and principles of distributed systems.
2. To introduce the architectures and models of distributed systems
3. To familiarize with communication, Synchronization, Consistency and Replication, Fault Tolerance in distributed systems.
4. To provide understanding of various security issues in distributed environments

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. Demonstrate the distributed communication mechanisms like RPC and RMI.
4. Describe various naming and synchronization mechanism in distributed systems
5. Apply Consistency, Replication and Fault Tolerance in distributed systems.
6. Compare and contrast various distributed object-based systems

UNIT – I
Introduction: Definition of A Distributed System; Goals- Making Resources Accessible, Distribution Transparency, Openness, Scalability, Pitfalls; 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, Discussion.

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.

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Communication: Fundamentals- Layered Protocols, Types of Communication; Remote Procedure Call- Basic RPC Operation, Parameter Passing; Asynchronous RPC, Example: DCE RPC; Message-Oriented Communication- Message Oriented Transient Communication, Message Oriented Persistent Communication, Example: IBM'S Web-Sphere Message-Queuing System; Stream-Oriented Communication- Support for Continuous Media, Streams and Quality of Service, Stream Synchronization; Multicast Communication, Application-Level Multicasting, Gossip-Based Data Dissemination.

UNIT-III

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, Example: The Domain Name System; 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 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;

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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", PHI, Second Edition, 2014
2. Colouris G., Dollimore Jean and Kindberg Tim, "Distributed Systems Concepts and Design", Pearson education, 3rd Edition, 2002.

Suggested Reading:

1. Sunitha Mahajan, Seema Shah, "Distributed Computing", Oxford University Press, Second Edition, 2013
2. Kai Hwang, Geoffery C.Fox, Jack J.Dongarra, "Distributed and Cloud Computing", Morgan Kaufmann publishers, 2012.
3. S.Ghosh, Chapman & Hall/CRC, "Distributed Systems", Taylor & Francis Group, 2010.
4. Ajay D. Kshemakalyani & MukeshSinghal, "Distributed Computing, Principles, Algorithms and Systems", Cambridge, 2010.

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IT 414

VLSI TECHNOLOGY

Instruction	4 L periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites: Basic Electronics, Digital Electronics, Computer Organization.

Course Objectives:

1. To introduce the students to the fundamentals of CMOS circuits, to understand basic electrical properties of MOS circuits and the design process at gate level and subsystem level
2. To develop an understanding of VLSI Design Flow and Transistor-Level CMOS Logic Design
3. To familiarize with VLSI Fabrication and Experience CMOS Physical Design

Course Outcomes:

After completing the course, student will be able to

1. Use circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnections.
2. Create models of moderately sized CMOS circuits that realize specified digital functions.
3. Know the Fabrication process of a chip .
4. Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects.
5. Understand the characteristics of CMOS circuit construction and compare state-of-the-art CMOS process and emerging electronic circuit technologies and processes.
6. Complete a significant VLSI design project having a set of objective criteria and design constraints.

UNIT-I

An overview of VLSI, Moore's law, Electrical Conduction in Silicon, Electrical Characteristics of MOSFETs Threshold voltage, n-FET Current-Voltage equations, square law and linear model of a FET, MOS capacitances, gate-source and gate drain capacitances, junction capacitances in a MOSFET, RC model of a FET, Modeling small MOSFET, scaling. MOSFET as switches, pass characteristics, logic gates using CMOS, Bubble pushing, XOR and XNOR gates, AOI and OAI logic gates, transmission gates. TG based 2-to-1 MUX, XOR, XNOR, OR circuits.

UNIT-II

Physical structure of CMOS ICs, IC layers, layers used to create a MOSFET, Top and side view of MOSFETs, Silicon patterning or layouts for series and parallel connected FETs. Layouts of NOT gate, transmission gate, non-inverting buffer, NAND2, NOR2, Complex logic gate, 4 input AOI gate. Stick diagram representations. Layouts of Basic Structure: n-wells, active area definition, design of n^+, p^+ regions, masks for the n-FET, active contact cross section and mask set, metal1 line with active contact, poly contact: cross section and layout, vias and higher level metals. Latchup prevention.

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UNIT-III

Fabrication of CMOS ICs, CMOS process flow, Design rules: minimum space width, minimum spacing, surround, extension, cell concepts and cell based design, logic gates as basic cells, creation of new cell using basic gates. DC characteristics of the CMOS inverter symmetrical inverter, layouts, Inverter switching characteristics, RC switch model equivalent for the CMOS inverter, fan-out, input capacitance and load effects, rise time and fall time calculation, propagation delay, driving large capacitive loads, delay minimization in an inverter cascade.

UNIT-IV

Pseudo n-MOS, tri-state inverter circuits, clocked CMOS, charge leakage, Dynamic CMOS logic circuits, pre-charge and evaluation charge sharing, Domino logic, Dual rail logic networks, differential Cascade Voltage Switch Logic (CVSL) AND/NAND, OR/NOR gates, Complementary Pass Transistor Logic (CPL). The SRAM, 6T SRAM cell design parameters, writing to an SRAM, resistor model, multi-port SRAM, SRAM arrays, Dynamic RAMs: 1T RAM cell, charge leakage and refresh in a DRAM cell, NOR based ROM, ROM array using pseudo n-MOS circuitry, floating gate MOSFET, effect of charge storage on the floating gate, A E^2PROM word using floating gate n-FETs, logic gate diagram of the PLA, NOR based design, CMOS PLA, Gate arrays.

UNIT-V

VLSI Design flow, structural gate level modeling, gate primitives, gate delays, switch level modeling, behavioural and RTL operators, timing controls, blocking and non blocking assignments, conditional statements, Data flow modeling and RTL, Comparator and priority encoder barrel shifter, D latch Master slave D type flip-flop, Arithmetic circuits; half adder, full adder, AOI based, TG based, ripple carry adders, carry look ahead adders, High speed adders, multipliers. Interconnect modeling; Interconnect resistance and capacitance sheet resistance Rs, time delay, single and multiple rung ladder circuits, simple RC interconnect model, modeling interconnect lines with a series pass FET, cross talk, floor planning and routing, clocking, Testing of VLSI circuits.

Text Book:

1. John P. Uyemura, “Introduction to VLSI circuits and Systems”, John Wiley & Sons, 2002.
2. Douglas A. Pucknell, Kamran Eshraghian, “Basic VLSI Design” 3rd Edition, PHI, 2000.

Suggested Reading:

1. John P. Uyemura, “Chip design for submicron VLSI: CMOS layout and simulation” IE, Cengage learning, 2006.
2. Jan M. Rabey and others “Digital Integrated Circuits A design perspective”, Pearson Education
3. Kamran Eshraghian, Douglas A. Pucknell, and Sholeh Eshraghian, “Essentials of VLSI circuits and systems”, PHI, 2011.

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IT415

BIG DATA ANALYTICS LAB

Instruction	3 periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Prerequisites: Java and Web Programming, Data Warehousing and Data Mining, Computational Intelligence.

Course Objectives:

1. To provide the knowledge to setup a Hadoop Cluster
2. To impart knowledge to develop programs using MapReduce Technique
3. To learn file handling in HDFS
4. To introduce Pig, PigLatin and HiveQL to process big data
5. To learn machine learning operations using Mahout Hadoop
6. To introduce NoSQL databases

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. Write scripts using Pig to solve real world problems
4. Write queries using Hive to analyse the datasets
5. Model and build a recommendation system using Mahout Hadoop
6. Apply big data and echo system techniques for real world problems

Experiments:

1. Understanding and using basic HDFS commands
2. Word count application using MapperReducer on single node cluster
3. Analysis of Weather Dataset on Multi node Cluster
4. Working with files in Hadoop file system: Reading, Writing and Copying
5. Writing User Defined Functions/Eval functions for filtering unwanted data in Pig
6. Retrieving user login credentials from /etc/passwd using Pig Latin
7. Working with HiveQL.
8. Writing User Defined Functions in Hive
9. Perform classification & clustering in Mahout Hadoop
10. Building a Mahout Recommendation System on a Hadoop Cluster

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 4^{th} Edition, O'Reilly Media Inc, April 2015.
2. Alan Gates, "Programming Pig", O'Reilly Media Inc, 2011.

Suggested Reading:

1. Edward Capriolo, Dean Wampler, and Jason Rutherglen, "Programming Hive", O'Reilly Media Inc, October 2012.
2. VigneshPrajapati, "Big data Analytics with R and Hadoop", Packt Publishing, November 2013.

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Web Resources:

1. http://www.iitr.ac.in/media/facspace/patelfec/16Bit/index.html
2. https://class.coursera.org/datasci-001/lecture
3. http://bigdatauniversity.com/

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IT416

VLSI TECHNOLOGY LAB

Instruction	3 periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Prerequisites: Digital Electronics and Logic Design, Programming and Problem Solving

Course Objectives:
1. To introduce the students to understand basics in Hardware design using CAD tools
2. Understand and Experience Verilog Design Flow
3. Learn Transistor-Level CMOS Logic Design using both Verilog and VHDL
4. Understand VLSI Fabrication and experience CMOS Physical Design using backend tools

Course Outcomes:
Upon successful completion of this course, student will be able to

1. Use CAD tools to program digital electronics circuits
2. Create models of CMOS circuits that realize specified digital functions.
3. Do simulation and synthesis process for design of CMOS technology
4. Understand process and emerging tools in electronic circuit technologies
5. Complete a small significant VLSI design project having a set of objective criteria and design constraints.
6. Experience the difference in both Hardware design tools

Experiments:
1. Switch level modeling using Verilog
   a) Logic gates b) AOI and OAI gates c) Transmission gate
   d) Complex logic gates using CMOS

2. Structural Gate-level modeling[With and without delays] – Digital circuits using gate primitives – using Verilog.
   a) AOI and OAI gate b) Half adder and full adders c) MUX using buffers
   d) S-R latch etc.
3. Mixed gate –level and Switch-level modeling using Verilog-usage of primitives, modules and instancing and understanding the hierarchical design.
   a) Constructing a 4-input AND gate using CMOS 2-input NAND and NOR gates.
   b) Constructing a decoder using CMOS 2-input AND gates and NOT gates etc.

4. RTL modeling of general VLSI system components.(Verilog)
   a) MUX es b) Decoders
   c) Priority encoders d) Flip-flops &Latch e) Registers.

5. Synthesis of Digital Circuits
   a) Ripple carry adder and carry look-ahead adder
   b) Array multiplier

6. Verilog code for finite state machine

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7. Structural Gate-level modeling [With and without delays] – Digital circuits using gate primitives – using VHDL.
   a) AOI and OAI gate b) Half adder and full adders c) MUXes

8. RTL modeling of general VLSI system components using VHDL.
   a) Decoders c) Priority encoders d) Flip-flops &Latches e) Registers

9. Design of 4-bit ALU with 8 instructions using VHDL.

10. Design of 4-bit Comparator using VHDL.

Suggested Reading:

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2nd Edition, IEEE 1364-2001 Compliant, Pearson Education, 2005.

2. Stephen Brown, ZvonkoVranesic, “Fundamentals of Digital Logicwith VHDL design”, 2nd Edition, McGraw Hill, 2009.

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IT417

PROJECT SEMINAR

Instruction	3 periods per week
Sessional	25 Marks
Credits	1

The objective of the project seminar is to actively involve the student in the initial work required to undertake the final year project. Dealing with a real time problem should be the focus of the under graduate project.

It may comprise of

- Problem definition and specifications.
- A broad understanding of the available techniques to solve a problem of interest.
- Presentation (Oral & written) of the project.

The department should appoint a project coordinator who will coordinate the following.

- Grouping of students as project batch(a maximum of 3 in group)
- Allotment of projects and project guides
- Project monitoring at regular intervals.

Each project group/batch is required to

1. Submit a one page synopsis of the seminar to be delivered for display on notice board.
2. Give a 30-40 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write up on the talk delivered.

Three (3) teachers will be associated with the evaluation of the project seminar for the award of the Sessional marks which should be on the basis of performance on all the three items stated above.

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IT 461

INFORMATION RETRIEVAL SYSTEMS
(Elective-II)

Instruction	4 L periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites: Database Systems, Data Warehousing and Data Mining

Course Objectives:
1. Learn how to build index of the unstructured data for information retrieval problem
2. To understand basic IR Models
3. To understand various techniques to compress indexing, matching, organizing, and evaluating methods to IR problems
4. To know various classification and clustering algorithms

Course Outcomes:
Students should have gained a good understanding of the foundation concepts of information retrieval techniques and should be able to:

1. Build and manage the unstructured data into a well-organized structure
2. Compress the structured data and apply IR principles to locate relevant information from large collections of data
3. Analyze performance of retrieval systems
4. Apply classification techniques on unstructured data
5. Apply clustering techniques on unstructured data
6. To Analyse current research problems in information retrieval

UNIT- I
Boolean retrieval: An example information retrieval problem, A first take at building an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval.
The term vocabulary and postings lists: Document delineation and character sequence decoding, determining the vocabulary of terms, faster postings list intersection via skip pointers, Positional postings and phrase queries.
Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, spelling correction, Phonetic correction.
Index construction: Hardware basic, Blocked sort-based indexing, Single-pass in-memory indexing, distributed indexing, dynamic indexing.

UNIT- II
Index compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression.
Scoring, term weighting and the vector space model:Parametric and zone indexes, Term frequency and weighting, Vector space model for scoring, Variant tf-idf functions.
Computing scores in a complete search system: Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction.

UNIT- III

Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance, A broader perspective: System quality and user utility.

Relevance feedback and query expansion: Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.

Probabilistic information retrieval: Review of basic probability theory, The Probability Ranking Principle, The Binary Independence Model.

UNIT- IV

Text classification: The text classification problem, Naive Bayes text classification, The Bernoulli model, Properties of Naive Bayes, Feature selection, Evaluation of text classification.

Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k nearest neighbour, Linear versus nonlinear classifiers, Classification with more than two classes, the bias-variance trade-off.

Support vector machines and machine learning on documents: Support vector machines: The linearly separable case, Extensions to the SVM model, Issues in the classification of text documents, Machine learning methods in ad hoc information retrieval.

UNIT- V

Flat clustering: Clustering in information retrieval, Problem statement, Evaluation of clustering, K-means, Model-based clustering.

Hierarchical clustering: Hierarchical agglomerative clustering, Single-link and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Optimality of HAC, Divisive clustering, Cluster labelling.

Matrix decompositions and latent semantic indexing: Linear algebra review, Term-document matrices and singular value decompositions, Low-rank approximations, Latent semantic indexing.

Text Book:

1. Christopher D. Manning and Prabhakar Raghavan and Hinrich Schütze, “Introduction to Information Retrieval”, Cambridge University Press, 2009.
2. David A. Grossman, OphirFrieder, “Information Retrieval – Algorithms and Heuristics”, Springer, 2nd Edition, Universities Press, 2004.

Suggested Reading:

1. Kowalski, Gerald and Mark T Maybury, “Information Storage and Retrieval Systems: Theory and Implementation”, Springer.
2. Baeza-Yates Ricardo and Berthier Ribeiro-Neto “Modern Information Retrieval”, 2nd edition, Addison-Wesley, 2011.

Web links:

1. https://class.coursera.org/nlp/lecture
2. http://www.dcs.gla.ac.uk/Keith/Preface.html

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IT 464

RESEARCH METHODOLOGY

(Elective-II)

Instruction	4 L periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites: Mini Projects

Course Objectives:

1. To assist in the planning and carrying out research projects.
2. To understand the principles, procedures and techniques of implementing a research project.
3. To understand the tools used for data analysis

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Define and describe the research process and research methods
2. Apply basic research methods including research design, data analysis, and interpretation.
3. Identify and analyse the problems
4. Apply analytical tools to solve the problem
5. Use Quantitative Techniques methods to provide soltuions
6. Develop technical reports using LaTex

UNIT -I

Research Methodology :Description: Introduction - meaning of research - objectives of research -motivation in research - types of research - research approaches - significance of research -research methods versus methodology - research and scientific method -importance of knowing how research is done - research processes - criteria of good research - defining research problem - selecting the problem - necessity of defining the problem - techniques involved in defining a problem –research design - meaning of research design - need for research design - features of good design - different research designs - basic principles of experimental design.

Originality in Research: Resources for research - research skills –time management - role of supervisor and scholar - interaction with subject experts.

Thesis Writing: The preliminary pages and the introduction - the literature review - methodology - the data analysis - the conclusions - the references (IEEE format).

UNIT- II

Review of Literature: Significance of review of literature –source for literature: books - journals – proceedings - thesis and dissertations -unpublished items.

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On-line Searching: Database – SciFinder – Scopus - Science Direct –Searching research articles - Citation Index - Impact Factor - H-index etc,

UNIT- III

Introduction of analytical tools – Introduction to data analysis –least squares fitting of linear data and non-linear data - exponential type data -logarithmic type data - power function data and polynomials of different orders -plotting and fitting of linear, Non-linear, Gaussian, Polynomial, and Sigmoidal type data - fitting of exponential growth, exponential decay type data –plotting polar graphs - plotting histograms - Y error bars - XY error bars - data masking.

UNIT- IV

Quantitative Techniques: General steps required for quantitative analysis -reliability of the data - classification of errors – accuracy – precision –statistical treatment of random errors - the standard deviation of complete results –error proportion in arithmetic calculations - uncertainty and its use in representing significant digits of results - confidence limits - estimation of detection limit.

UNIT- V

LaTeX and Beamer: Description: Writing scientific report - structure and components of research report - revision and refining' - writing project proposal - paper writing for international journals, submitting to editors - conference presentation –preparation of effective slides, pictures, graphs - citation styles.

Text Books:

1. C. R. Kothari, "Research Methodology Methods and Techniques", New Age International Publishers, New Delhi, 2nd edition, 2009.
2. F. Mittelbach and M. Goossens, "The LATEX Companion", Addison Wesley, 2nd edition, 2004.

Suggested Reading:

1. R. Panneerselvam, "Research Methodology", PHI, 2005.
2. P. Oliver, "Writing Your Thesis", Vistaar Publications, 2004.
3. J. W. Creswell, "Research Design: Qualitative, Quantitative, and Mixed Methods & Approaches", Sage Publications, 3rd edition, 2008.
4. Kumar, "Research Methodology: A Step by Step Guide for Beginners", SAGE Publications, 2005.

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Web Resources:

1. Web link: http://nptel.ac.in/syllabus/106102114/
2. http://www.cse.hcmut.edu.vn/~tuananh/courses/parallel_computing/Parhami%20B.%20Introduction%20to%20Parallel%20Processing%20%20Algorithms%20and%20Architectures%20(Kluwer,%202002).pdf

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CE 422 **DISASTER MITIGATION AND MANAGEMENT**

Instruction	4 Periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

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, mechanism causes, consequences and mitigation measures of the various natural disasters including hydro metrological and geological based disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters including chemical, biological and nuclear warfare agents.
4. To equip the students with the knowledge of various chronological phases in the disaster management cycle.
5. To create awareness about the disaster management framework and legislations in the context of national and global conventions.
6. To enable students to understand the applications of geospatial technologies like remote sensing and geographical information systems in disaster management.

Course Outcomes:

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at local level
2. Ability to 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 natural and human induced disasters for the participatory role of engineers in disaster management.
4. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans
5. Ability to understand various participatory approaches/strategies and their application in disaster management
6. Ability to understand the concepts of remote sensing and geographical information systems for their effective application in disaster management.

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UNIT-I:

Introduction to Natural, human induced and human made disasters – Meaning, nature, types and effects; International decade of natural disaster reduction (IDNDR); International strategy of natural disaster reduction (ISDR)

UNIT-II:

Natural Disasters– Hydro meteorological disasters: Causes, impacts, Early warning systems, structural and non-structural measures for floods, drought and cyclones; Tropical cyclones: Overview, cyclogenesis, drought monitoring and management.; Geographical based disasters: Earthquakes and Tsunami- Overview, causes, impacts, zoning, structural and non-structural mitigation measures; Tsunami generation; Landslides and avalanches: Overview, causes, impacts, zoning and mitigation measures. Case studies related to various hydro meteorological and geographical based disasters.

UNIT III:

Human induced hazards: Risks and control measures in a chemical industry**,** Causes, impacts and mitigation measures for chemical accidents, chemical disaster management, current status and perspectives; 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 and traffic accidents .

UNIT IV:

Use of remote sensing and GIS in disaster mitigation and management; Scope of application of ICST (Information, communication and space technologies in disaster management, Critical applications & Infrastructure; Potential application of Remote sensing and GIS in disaster management and in various disastrous conditions like earthquakes, drought, Floods, landslides etc.

UNIT V:

Concept of Disaster Management: Introduction to disaster management, Relationship between Risk, vulnerability and a disaster, Disaster management cycle, Principles of disaster mitigation: Hazard identification and vulnerability analysis, Early warning systems and forecasting; Infrastructure and development in disaster management; Disaster management in India: National disaster management framework at central, state, district and local levels. Community based disaster management.

Text Books:

1. Rajib, S and Krishna Murthy, R.R, "Disaster Management Global Challenges and Local Solutions" Universities Press Hyderabad 2012.
2. Notes / Reading material published by National Disaster Management Institute, Ministry of Home Affairs, Govt. of India.

Suggested Reading:

1. Navele, P & Raja, C.K., Earth and Atmospheric Disasters Management, Natural and Manmade. B.S. Publications, Hyderabad 2009.
2. Fearn-Banks, K, Crises computations approach: A case book approach. Route ledge Publishers, Special Indian Education, New York & London 2011.
3. Battacharya, T., Disaster Science and Management. Tata McGraw Hill Company, New Delhi 2012.

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IT 421

EMBEDDED SYSTEMS& INTERNET OF THINGS

Instruction	4 L periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites: Digital Logic and Design, C programming, Microelectronics, Computer Organization

Course Objectives:

1. To teach students theoretical aspects of the design and development of an embedded system, including hardware and embedded software development.
2. To familiarize students with the basic concepts and structure and development of embedded systems.
3. To provide an overview of Internet of Things, building blocks of IoT and the real-world applications
4. To introduce Rasberry Pi device, its interfaces and Django Framework.

Course Outcomes:

1. Possess the passion for acquiring knowledge and skill in development of embedded systems.
2. Design and develop embedded systems (hardware, software and firmware)
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 about generic design methodology for IoT system design.
6. Describe about the Rasberry Pi board and interfacing sensors and actuators with Rasberry Pi and work with python based web application framework called Django.

UNIT-I

Embedded Computing: Introduction, Complex Systems and Microprocessor, Embedded System Design Process, Formalisms for System Design, Design Examples. 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, Serial Data Communication. Introduction to Real- Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipe.

UNIT-III

Basic Design Using a Real-Time Operating System: Principles, Semaphores and Queues, Hard Real-Time Scheduling Considerations, Saving Memory and Power, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment. Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded

Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, Introduction to advanced architectures: ARM and SHARC Processor and memory organization, Bus protocols, 12C bus and CAN bus.

UNIT-IV

Introduction & Concepts: 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.

Domain Specific IOTs: Various types of IoT Applications in Home Automation, Cities, Environment, Energy, Retail, Logistics Agriculture, Industry, Health & Life Style-Wearable Electronics.

UNIT-V

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, Rasberry Pi- About the board, Rasberry Pi interfaces-Serial, SPI,I2C.

Python Web Application Framework: Django Framework-Roles of Model, Template and View.

Text Books:

1. Wayne Wolf, “Computers and Components”, Elsevier.
2. Kenneth J.Ayala, “The 8051 Microcontroller”, Third Edition, Thomson.
3. David E. Simon, “An Embedded Software Primer”, Pearson Education.
4. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-on Approach”, Universities Press.

Suggested Reading:

1. Raj Kamal, “Embedded Systems”, Tata McGraw Hill.
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.
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.

IT 422

EMBEDDED SYSTEMS & IoT LAB

Instruction	3 periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Prerequisites: Micro Processors Lab

Course Objectives:

1. To teach students all aspects of the design and development of an embedded system, including hardware and embedded software development.
2. To provide necessary knowledge to develop working code for real-world IoT applications

Course Outcomes:

After completion of the 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. Experience Programming in Real Time Operating System using VxWorks.
4. Develop python programs that run on Rasberry Pi
5. Interface Sensors and Actuators with Rasberry Pi
6. Develop simple IoT systems using Rasberry Pi device and appropriate sensors and Django Framework.

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, Sensors, ADCs, Timers
2. Demonstrate Communications: RS232, IIC and CAN protocols
3. Develop Control Applications such as: Temperature Controller, Elevator Controller, Traffic Controller

B. Understanding Real Time Concepts using any RTOS through Demonstration of:

1. Timing
2. Multi-Tasking
3. Semaphores
4. Message Queues
5. Round-Robin Task Scheduling
6. Pre-emptive Priority based Task Scheduling
7. Priority Inversion
8. Signals
9. Interrupt Service Routines

C. **Internet of Things (IoT) Experiments**

Following are some of the programs that a student should be able to write and test on an Raspberry Pi, but not limited to this only.

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1. Python- Installation, Working with Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Control flow examples, Pass statement, Functions, Modules, Packages, File Handling, Date/Time operations, Classes
2. Create a Python program to compute document statistics
3. Switching LED on/off from Rasberry Pi Console
4. Python program for blinking LED
5. Interfacing an LED and Switch with Rasberry Pi
6. Python program for sending an email on switch press
7. Interfacing a Light Sensor with Rasberry Pi
8. Implement any IoT application using Rasberry Pi, Python and Django Framework

Student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.

Text Book:

1. Kenneth J.Ayala, “The 8051 Microcontroller”, Third Edition, Thomson.
2. ArshdeepBahga, Vijay Madisetti, “Internet of Things: A Hands-on Approach”, Universities Press.

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IT 423

SEMINAR

Instruction	3 Periods per week
Sessional	25 Marks
Credits	1

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of 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. The seminar topic must be chosen from a standard publication (IEEE/ACM/Springer/ Elsevier/John Wiley & Sons Publishing Company etc.) with a prior approval from the designated faculty.

Students are to be exposed to following aspects of seminar presentations.

- Literature survey
- Consolidation of available information
- Power point Preparation
- Technical writing

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.

2. Give twenty(20) minutes presentation through OHP/ PPT/ Slide Projector followed by Ten(10) minutes discussion

3. Submit a report on the seminar topic with list of references and hard copy of the slides.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule should 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 should be from any peer reviewed recent journal publications.

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IT 472

SOCIAL MEDIA ANALYTICS
(Elective- III)

Instruction	4 L periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites: Data Structures, Design and Analysis of Algorithms, Data Warehousing and Data Mining, Computational Intelligence, Big Data Analytics

Course Objectives:
1. To introduce the basics of Social media mining and challenges in mining social media data
2. To discuss graph essentials, network essentials and network models for social media mining
3. To teach the process of detecting, analyzing communities and Information diffusion in the context of Social media analytics
4. To impart knowledge about mining essentials and importance of influence and homophily
5. To discuss recommendation systems in the context of social media
6. To introduce the working of prediction systems

Course Outcomes:
After Completion of the course, student will be able to
1. Understand and analyse the challenges posed by social media data
2. Represent social media using a suitable network model
3. Perform community analysis and analyse herd behaviour
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: What is 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

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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.

Suggested Reading:

1. Bing Liu, "Sentiment Analysis: mining opinions, sentiments, and emotions", Cambridge University Press, 2015.
2. 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://simplymeasured.com/free-social-media-tools/#sm.0001p0rf42mqwdxnu1s1j6llvxvix
4. http://blogs.iit.edu/iit_web/social-media-2/social-media-whats-your-strategy/

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IT 476

ELECTRONIC COMMERCE
(Elective-III)

Instruction	4 L periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites: Computer Networks, Information Security

Course Educational Objectives:
1. To introduce the concepts and importance of E-commerce.
2. To facilitate understanding of the importance of ethics, legal issues and privacy in E-Commerce.
3. To familiarize with various electronic payment systems, advertising and marketing on the web.

Course Outcomes:
Students who complete this course will be able to
1. Understand the impact of information superhighway and multimedia on global business and life style.
2. Explain the significance of Electronic data interchange and legal, security and privacy issues.
3. Describe the digital documentations, market research and corporate data warehouses, and their usage in the business strategy formulation.
4. Understand the significance of the various modes of electronic payments and the risks involved.
5. Explain the significance of organizing the data in a consumer oriented view.

UNIT-I
Electronic Commerce: Electronic Commerce Frame Work, Electronic Commerce and Media Convergence, Anatomy of E-Commerce appellations, Electronic Commerce Consumer applications, Electronic Commerce Organization Applications.
Consumer Oriented Electronic Commerce: Consumer- Oriented Applications, Mercantile Process Models, Mercantile Models from the Consumer's Perspective, Mercantile Models from the Merchants' Perspective.

UNIT-II
Electronic Payment systems: Types of Electronic Payment Systems, Digital Token - Based Electronic Payment Systems, Smart Cards Electronic Payment Systems, Credit Card- Based Electronic Payment Systems, Risk and Electronic Payment systems, Designing Electronic Payment Systems.

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UNIT -III

Inter Organizational Commerce and EDI: Electronic Data Interchange, EDI applications in business, EDI: Legal, Security, and Privacy issues, EDI and Electronic Commerce. EDI Implementation, MIME and Value added networks.-Standardization and EDI, EDI Software Implementation, EDI Envelope for Message Transport, Value-Added Networks, Internet-Based EDI.

Intra organizational Electronic Commerce: Internal Information Systems, Work Flow Automation and Coordination, Customization and internal Commerce, Supply chain Management.

UNIT-IV

Corporate Digital Library: Dimensions of Internal electronic Commerce Systems, Types of Digital Documents, Issues behind Document Infrastructure, Corporate Data Warehouse Advertising and Marketing on the Internet - Information based marketing, advertising on Internet, on-line marketing process, market research.

UNIT -V

Consumer Search and Resource Discovery: Search and Resource Discovery paradigms, Information search and Retrieval, Electronic Commerce catalogues or Directories, information filtering, Consumer-Data Interface, Emerging Tools.

Multimedia and Digital video: key multimedia concepts, Digital Video and Electronic Commerce, Desktop video processing, Desktop video conferencing.

Text Book:

1. Ravi Kalakota & A. B. Whinstong: "Frontiers of Electronic Commerce", Pearson Education, lndia, 2006.

Suggested Reading:

1. Daniel Minoli, Emma Minoli, "Web Commerce Technology Handbook" Tata McGraw Hill 2007.
2. J Christopher W, Theodore HKC, "Global Electronic Commerce: Theory and Case Studies", Universities Press, 2001.

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IT 477

DATA ANALYSIS USING R PROGRAMMING
(Elective-III)

Instruction	4 L periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites: Probability and Random Processes, Java Programming, Big Data Analytics

Course objectives:
To introduce R, an easy to use tool for high level data analytics.

Course outcomes:
After successful completion of the course students will be able to
1. Learn and use various built-in data types in R and read and write data from other datasets using R packages.
2. Use Textual and binary formats for storing data and perform numerical and statistical calculations using Vectorized operations, Date and Time.
3. Perform operations for managing Data frames using dplyr package and write programs using control structures and Functions.
4. Appreciate lexical scoping of R that simplifies statistical computations and use loop functions to implement loops in a compact form.
5. Debug programs using interactive debugging tools of R and optimize R programs using Rprofiler
6. Simulate a system by modeling random inputs using random number generators.

UNIT-I
History and Overview of R: Basic Features of R, Design of the R System, Limitations of R, R Resources, **Introduction to R:**Installation, Interface, Entering Input, Evaluation, R Objects, Numbers, Attributes, Creating Vectors, Mixing Objects, Explicit Coercion, Matrices, Lists, Factors, Missing Values, Data Frames, Names, **Getting Data In and Out of R :**Reading and Writing Data, Reading Data Files with read.table(), Reading in Larger Datasets with read.table, Calculating Memory Requirements for R Objects, **Using the readr Package**

UNIT-II
Using Textual and Binary Formats for Storing Data: Usingdput() and dump(), Binary Formats, **Interfaces to the Outside World**: File Connections, Reading Lines of a Text File, Reading From a URL Connection, **Subsetting R Objects**: Subsetting a Vector, Subsetting a Matrix, Subsetting Lists, Subsetting Nested Elements of a List Extracting Multiple Elements of a List, Partial Matching, Removing NA Values, **Vectorized Operations**:Vectorized Matrix Operations, **Dates and Times**: Dates in R, Times in R, Operations on Dates and Times.

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UNIT-III

Managing Data Frames: Data Frames, The dplyr Package, dplyr Grammar, Installing the dplyr package, select(), filter(), arrange(), rename(), mutate(), group_by(), Pipeline operator, **Control Structures**: if-else, for Loops, Nested for loops, while Loops, repeat Loops, next, break, **Functions**: Functions in R, Argument Matching, Lazy Evaluation, The ... Argument, Arguments Coming After the ... Argument.

UNIT-IV

Scoping Rules of R:A Diversion on Binding Values to Symbol, Scoping Rules, Lexical Scoping: Lexical vs. Dynamic Scoping, Application: Optimization, Plotting the Likelihood, **Coding Standards for R, Loop Functions**:, Looping on the Command Line, lapply(), sapply(), split(), Splitting a Data Frame, tapply, apply(), Col/Row Sums and Means, Other Ways to Apply, mapply(), Vectorizing a Function, **Debugging:** Figuring Out What's Wrong, Debugging Tools in R, Using traceback(), Using debug(), Using recover().

UNIT-V

Profiling R Code: Usingsystem.time(), Timing Longer Expressions, The R Profiler Using summaryRprof(), **Simulation:** Generating Random Numbers, Setting the random number seed, Simulating a Linear Model, Random Sampling, **Data Analysis Case Study:**Simulation, Loading and Processing the Raw Data , Results.

Text Book:

1. Ravi Kalakota & A. B. Whinstong, "Frontiers of Electronic Commerce", Pearson Education, lndia, 2006.

Suggested Reading:

1. Daniel Minoli, Emma Minoli, "Web Commerce Technology Handbook", Tata McGraw Hill 2007.
2. J Christopher W, Theodore HKC, "Global Electronic Commerce: Theory and Case Studies", Universities Press, 2001.

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IT 481

CLOUD COMPUTING
(Elective-IV)

Instruction	4 L periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course prerequisites: Operating Systems, Distributed Systems

Course Objectives:

1. To introduce mechanisms that enable cloud computing
2. To familiarize with the architecture and standards of cloud computing
3. To facilitate understanding of different virtualization technologies
4. To provide an introduction to various cloud platforms

Course Outcomes:

After successful completion of the course, student will be able to

1. Describe the features of clouds and basic principles of cloud computing
2. Discuss system virtualization and outline its role in enabling the cloud computing system model.
3. Analyze and apply various clouds architectures
4. Identify the security requirements of cloud computing
5. Develop applications on different cloud platforms

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-Centre Automation.

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 Holomorphic 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.

Text Books:

1. John W. Rittenhouse, James F. Ransome, "Cloud Computing: Implementation, Management, and Security ", CRC Press, 2009.
2. RajkumarBuyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", WileyPublishing, 2011.

Suggested Reading:

1. Kai Hwang, Geoffrey C.Fox, Jack J.Dongarra, "Distributed and Cloud Computing from Parallel Processing to the Internet of Things", Elsevier, 2012.
2. Raluca Ada Popa, Catherine M.S.Redfield, NickolaiZeldovich and HariBalakrishnana, "CryptDB: Protecting Confidentiality with encrypted Query Processing" 23rd ACM Symposium on Operating Systems Principles (SOSP 2011), Cascais, Portugal October 2011.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", AuerbachPublications(CRC Press), 2006.

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ME 464

Entrepreneurship (Elective – IV)

Instruction	4 Periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To understand the essence of Entrepreneurship
2. To know the environment of industry and related opportunities and challenges
3. To know the concept a procedure of idea generation
4. To understand the elements of business plan and its procedure
5. To understand project management and its techniques
6. To know behavioral issues and Time management

Course Outcomes: After completing this course, students will be able to:

1. Apply the entrepreneurial process
2. Analyze the feasibility of a new business plan and preparation of Business plan
3. Evaluate entrepreneurial tendency and attitude
4. Brainstorm ideas for new and innovative products or services
5. Use project management techniques like PERT and CPM
6. 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

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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”, Tata Me Graw Hill Publishing Company Ltd., 5lh Ed., 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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ME 472

Intellectual Property Rights (Elective – III)

Instruction	4 Periods per week
Duration of End Semester Examination	3 Hours
End Semester Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:
1. To introduce fundamental aspects of IP
2. Introducing all aspects of IPR acts.
3. Creating awareness of multi disciplinary audience
4. Creating awareness for innovation and its importance
5. Exposing to the changes in IPR culture
6. Awareness about techno-business aspects of IPR

Course 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. Capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IP. .
6. Capable of converting creativity into IP 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.

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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. Cronish W.R1 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, Sweet, Maxwell 4th Edition.

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IT 901 **PROJECT**

Instruction	6 Periods per week
Duration of End Semester Examination	Viva-voce
End Semester Examination	100 Marks
Sessional	50 Marks
Credits	9

Dealing with a real time problem should be the focus of under graduate project.

All projects will be monitored at least four times in the II-semester through individual presentations (Project batch wise).

Every student should maintain a project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Sessional marks should be based on the marks, awarded by a project monitoring committee of faculty members as well as the marks given by the guide.

Common norms are established for final documentation of the project report, the students are directed to download from the website regarding the guidelines for preparing the project report and the project report format.

The project report shall be evaluated for 100 Marks by the External Examiner.

If the project work found inadequate in the end examination, the candidate should repeat the project work with a new problem or improve the quality of work and report it again.

Break up for 100 Marks in the end examination:

1. Power point presentation 20 Marks
2. Thesis/Report preparation 40 Marks
3. Viva-voce 40 Marks

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IT 5101

NUMBER THEORY

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Course Objectives:

1. To learn the basics concepts of number theory
2. To be familiar with linear congruences and Chinese remainder theorem
3. To know Fermat's little theorem, and Euler's extension of it;

Course Outcomes:

After the completion of the course, student will be able to

1. Solve the problems of elementary number theory
2. Apply number theory concepts to cryptography

UNIT – I : Divisibility and Primes : Division Algorithm, Euclid’s algorithm for the greatest common divisor, Linear Diophantine equations, Prime numbers, fundamental theorem of arithmetic, infinitude of primes. Distribution of primes, twin primes, Goldbach conjecture, Fermat and Mersenne primes, Primality testing and factorization.

UNIT – II : Congruences, Congruences with a Prime-Power Modulus : Modular arithmetic, Linear congruences, Simultaneous linear congruences, Chinese Remainder Theorem, An extension of Chinese Remainder Theorem (with non-coprime moduli), Arithmetic modulo p, Fermat's little theorem, Wilson's theorem, Pseudo-primes and Carmichael numbers, Solving congruences modulo prime powers.

UNIT – III:Euler's Function and RSA Cryptosystem, Units Modulo an Integer : Definition of Euler function, examples and properties, Multiplicative property of Euler's function, RSA cryptography, The group of units modulo an integer, primitive roots, Existence of primitive roots.

UNIT – IV:Quadratic Residues and Quadratic Forms : Quadratic residues, Legendre symbol, Euler's criterion, Gauss lemma, law of quadratic reciprocity, Quadratic residues for prime-power moduli and arbitrary moduli.

UNIT – V: Binary quadratic forms, equivalent forms, Discriminant, principal forms, positive definite forms, indefinite forms, Representation of a number by a form-examples, Reduction of

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positive definite forms, reduced forms, Number of proper representations, automorph, class number.

Suggested Reading :

1) G.A. Jones & J.M. Jones, "Elementary Number Theory", Springer UTM, 2007.
2) Niven, H.S. Zuckerman & H.L. Montgomery, "Introduction to the Theory of Numbers", Wiley,2000.
3) D. Burton, "Elementary Number Theory", McGraw-Hill, 2005.

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IT 5102

ADVANCED ALGORITHMS

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Course Objectives:

1. To understand asymptotic notation for representing Algorithmic complexity
2. To understand various algorithmic strategies like greedy method, divide and conquer and dynamic programming
3. To learn advanced algorithms for networks, string processing and geometry

Course Outcomes:

After the completion of the course, student will be able to

1. Formulate and seek known solutions to an algorithmic problem.
2. Select suitable algorithmic strategy and appropriate data structures for solving real world problems in various domains.
3. To read and understand current research publications in the area of algorithms.

UNIT-I

Algorithm Analysis: Asymptotic Notation, Amortization.

Basic Data Structures: Stacks and Queues, Vectors, Lists and Sequences, Trees, Priority Queues, Heaps, Dictionaries and Hash Tab1es.

Search Trees and Skip Lists: Ordered Dictionaries and Binary Search Trees, AVL Trees, Bounded- Depth Search Trees, Splay Trees, Skip Lists.

UNIT-II

Fundamental Techniques: The Greedy Method, Divide-and-Conquer, Dynamic Programming.

Graphs: The Graph Abstract Data Type, Data Structures for Graphs, Graph Traversal, Directed Graphs.

UNIT-III

Weighted Graphs: Single-Source Shortest Paths, All-Pairs Shortest Paths, Minimum Spanning Trees.

Network Flow and Matching: Flows and Cuts, Maximum Flow, Maximum Bipartite Matching, Minimum-Cost Flow.

UNIT-IV

Text Processing: Strings and Pattern Matching Algorithms, Tries, Text Compression, Text Similarity Testing.

Number Theory and Cryptography: Fundamental Algorithms involving numbers, Cryptographic Computations, Information Security Algorithms and Protocols.

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UNIT-V

Computational Geometry: Range Trees, Priority Search Trees, Quadtrees and k-DTrees, Convex Hulls.

Suggested Reading:

1) M T Goodrich, R Tornassia, "Algorithm Design - Foundations, Analysis, and Internet Algorithms ", John Wiley, 2002.
2) E Horowitz S Salmi, S Rajasekaran, "Fundamentals of Computer Algorithms" 2nd Edition, University Press, 2007.
3) Aho, A V Hopcraft, Ullman J D, "The design and analysis of Computer Algorithms", Pearson Education, 2007.
4) Hari Mohan Pandy, "Design Analysis and Algorithms", University Science Press, 2009.
5) Cormen, Lieserson, Rivest "Introduction to Algorithms", 2nd Edition, PHI, 2003.

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IT 5103

ADVANCED COMPUTER NETWORKS

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Course Objectives:

1. To build an understanding of the fundamental concepts of computer networks and networking devices
2. To understand basic concepts involved in the design of computer networks such as layering, architectures, protocols and services;
3. To familiarize with the recent developments on the Internet such as Ipv6 and mobile IP
4. To understand major concepts involved in WLANs, Optical, Wireless sensor and mobile Adhoc networks

Course Outcomes:

After the completion of the course, student will be able to

1. To list the applications of different types of networks such as WANs, LANs, WLANs, optical, mobile Adhoc and sensor networks
2. Describe the concepts, protocols and differences underlying the design and implementation of various types of computer networks
3. To propose, implement and evaluate new ideas for solving design issues related to these networks

UNIT- I

Computer Networks and the Internet: What is the Internet, The Network edge, The Network core, Access Networks and Physical media, ISPs and Internet Backbones, Delay and Loss in Packet-Switched Networks, History of Computer Networking and the Internet - **Foundation of Networking Protocols:** 5-layer TCP/IP Model, 7-layer OSI Model, Internet Protocols and Addressing, Equal-Sized Packets Model: ATM - **Networking Devices:** Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Router Structure.

UNIT- II

The Link Layer and Local Area Networks: Link Layer: Introduction and Services, Error-Detection and Error-Correction techniques- Multiple Access Protocols, Link Layer Addressing, Ethernet, Interconnections: Hubs and Switches, PPP: The Point-to-Point Protocol, Link Visualization - **Routing and Internetworking:** Network-Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Intradomain Routing Protocols, Interdomain Routing Protocols, Congestion Control at Network Layer.

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UNIT- III

Logical Addressing: IPv4 Addresses, IPv6 Addresses - **Internet Protocol:** Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6 - **Multicasting Techniques and Protocols:** Basic Definitions and Techniques, Intra-domain Multicast Protocols, Inter-domain Multicast Protocols, Node-Level Multicast algorithms - **Transport and End-to-End Protocols:** Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, TCP Congestion Control - **Application Layer:** Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, Building a Simple Web Server.

UNIT- IV

Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies. IEK1: S02.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs) - **Optical Networks and WDM Systems:** Overview of Optical Networks, Basic Optical Networking Devices, Large-Scale Optical Switches, Optical Routers, Wavelength Allocation in Networks, Case Study: An All-Optical Switch.

UNIT- V

VPNs, Tunneling and Overlay Networks: Virtual Private Networks (VPNs), Multiprotocol Label Switching (MPLS), Overlay Networks-**VoIP and Multimedia Networking:** Overview of IP Telephony, VoIP Signaling Protocols, Real-Time Media Transport Protocols, Distributed Multimedia Networking, Stream Control Transmission Protocol - **Mobile Ad-Hoc Networks:** Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks, Routing Protocols for Ad-Hoc Networks - **Wireless Sensor Networks:** Sensor Networks and Protocol Structures, Communication Energy Model, Clustering Protocols, Routing Protocols.

Suggested Reading:

1) James E Kuro.se, Keith W. Ross “Computer Networking: A Top-Down Approach Featuring the Internet”, Third Edition, Pearson Education, 2007.
2) Nader F. Mir “Computer and Communication Networks”, Pearson Education, 2007.
3) Behrouz A. Forouzan, “Data Communications and Networking”, Fourth Edition, Tata McGraw Hill, 2007.
4) Greg Tomsho.EdTittel, David Johnson, “Guide to Networking Essentials”, Fifth Edition, Thomson.
5) S. Keshav, “An Engineering Approach to Computer Networking ”,Pearson Education.
6) Diane Teare, Catherine Paquet, “Campus Network Design Fundamentals”, Pearson Education (CISCO Press).
7) Andrew S. Tanenbaum, “Computer Networks”, Fourth Edition, Prentice Hall.
8) A. Farrel,”The Internet and Its Protocols”, Elsevier.

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IT 5104

CRYPTOGRAPHY AND NETWORK SECURITY

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Course objectives:

1. To understand security threats, security services and mechanisms.
2. To understand different symmetric and asymmetric cryptography algorithms.
3. To understand network and email security protocols like SSL, PGP and S/MIME

Course outcomes:

Student will be able to

1. Demonstrate detailed knowledge of the role of cryptography to protect data.
2. Identify common network security vulnerabilities/attacks.

UNIT-I

Introduction: Attributes of Security, Integrity, Authenticity, Non-repudiation, Confidentiality, Authorization, Anonymity, Types of Attacks, DoS, IP Spoofing, Replay, Man-in-the-Middle attacks, General Threats to Computer Network, Worms, Viruses, Trojans

UNIT-II

Secret Key Cryptography: DES, Triple DES, AES, Key distribution, Attacks

Public Key Cryptography: RSA, ECC, Key Exchange (Diffie-Hellman), Java Cryptography Extensions, Attacks.

UNIT-III

Integrity, Authentication and Non-Repudiation: Hash Function (MD5, SHA5), Message Authentication Code (MAC), Digital Signature (RSA, DSA Signatures), Biometric Authentication.

UNIT-IV

PKI Interface: Digital Certificates, Certifying Authorities, POP Key Interface, System Security using Firewalls and VPN's.

Smart Cards: Application Security using Smart Cards, Zero Knowledge Protocols and their use in Smart Cards, Attacks on Smart Cards.

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UNIT-V

Applications: Kerberos, Web Security Protocols (SSL), IPSec, Electronic Payments, E-cash, Secure Electronic Transaction (SET), Micro Payments, Case Studies of Enterprise Security (.NET and J2EE).

Suggested Reading:

1) William Stallings, "Cryptography and Network Security", 5th Edition, Pearson, 2013.
2) Behrouz A Forouzan, "Cryptography and Network Security", TMH, 2009.
3) Joseph MiggaKizza, "A Guide to Computer Network Security ", Springer, 2010.
4) Dario Cataiano, Contemporary Cryptology ", Springer, 2010.
5) William Stallings, "Network Security Essentials: Application and standards", 4th Edition, Pearson, 2012.

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IT 5105

INFORMATION SYSTEMS SECURITY

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Course Objectives:

1. To understand fundamental concepts of information security and the key practices and processes for managing security effectively.
2. To describe software program deficiencies and the vulnerabilities associated with them.
3. To familiarize withaccess controls and authentication as they are used to secure systems and information.
4. To understand security vulnerabilities that affect operating systems and how they can be mitigated.

Course Outcomes:

A student completing this course is expected to be able to:

1. State the basic concepts in information systems security, including security technology and principles, software security and trusted systems, and IT security management.
2. State the requirements and mechanisms for identification and authentication.
3. State the criteria of evaluating secure information systems, including evaluation of secure operating systems and secure database systems.

UNIT- I

Information Systems in Global Context: Basicsandimportance of Information Systems, Changing Nature of Information Systems, Global Information Systems: Role of Internet and Web Services.

Threats to Information Systems: New Technologies Open Door to the Threats, Information-Level Threats versus Network-Level Threats, Threats and Attacks, Classifications of Threats and Assessing Damages, Protecting Information Systems Security.

UNIT- II

Information Security Management in Organizations: Information Security Management (ISM)Context, Policy, Standards, Guidelines and Procedures, Security Scenario in the Financial Sector, Information Security Management System (ISMS), Organizational Responsibility, Information Security Awareness Scenario.

Building Blocks of Information Security: Principles of Information Systems Security, Three Pillars of Information Security, Information Classification, Criteria for Classification of Data and Information, Information Classification: Variousroles.

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UNIT- III

Information Security Risk Analysis: Terms and Definitions for Risk Analysis of Information Security, Risk Management and Risk Analysis, Approaches and Considerations in Risk Analysis, Auditing Perspective on Risk Analysis.

Intrusion Detection for Securing the Networks: Intrusion Monitoring and Detection, Intrusion Detection for Information Systems Security.

Firewalls for Network Protection: Firewalls, Demilitarized Zone (DMZ), Need and Protection provided by Firewalls, Proxy Servers, Topologies for Different Types of Firewalls.

Virtual Private Networks for Security: VPN, Need and Role of a VPN for an Enterprise, Working of VPN,VPN Architecture.

UNIT- IV

Security of Electronic Mail Systems: Today's Email Usage Scenario, Email System Mechanism, Security Threats posed by Emails, Protection from Threats, Governance for Emails Systems.

Security of Databases: Database Security Issues, Federated Databases: Need and Security Issues, Securing the Mobile Databases, Securing Connectivity with Enterprise Databases, Data Integrity as a parameter for security, Database Security Policy.

Security of Operating Systems: Operating Systems role in Information Systems Application, Operating System Types, Functions and Tasks, Network Operating Systems and Security, Host Security and OS Hardening, Patched Operating System, OS hardening fundamentals.

UNIT- V

Security Models, Frameworks, Standards and Methodologies: Terminology, Methodologies for Information Systems Security.

Systems Security Engineering Capability Maturity Model - The SSE-CMM : Definition Nature, Scope and Importance,Target Audience for the SSE-CMM, SSE-CMM - Structure and Architecture, Process Areas of the SSE-CMM.

Auditing for Security: Need for Security Audits in Organizations, Organizational Roles and Responsibilities, Types and Approaches to Security Audits, Technology-based Audits - Vulnerability Scanning and Penetration Testing, Phases in Security Audit.

Suggested Reading :

1) Nina Godbole,**"**Information Systems Security: Security Management, Metrics, Frameworks And Best Practices", Wiley India Pvt.Ltd.,2013
2) Michael E. Whitman and Hebert J Mattord, "Principles of Information Security", 4th edition Ed. Cengage Learning 2011
3) Thomas R Peltier, JustingPeltier, John Blackley, "Information Security. Fundamentals", Auerbacj Publications 2010

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4) Detmar W Straub, Seymor Goodman, Richard L Baskerville, “Information Security: Policy
5) Processes and Practices”, PHI 2008
6) Marks Merkow and Jim Breithaupt, “Information Security: Principle and Practices”, Pearson Education, 2007.

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IT 6103

MACHINE LEARNING

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Course Objectives:
At the end of the course, student can

1. Discuss basic concepts of Machine Learning , problems and the other concepts such as algorithms, heuristics, solution spaces and relate them to brute force searching.
2. Understand the mathematical concepts related to Multilayer perception.
3. Demonstrate familiarity with various techniques in Machine Learning and their applications as well as general questions related to analyzing and handling large data sets

Course Outcomes :

Upon successful completion of the course, student

1. Acquire the basic knowledge of Machine Learning, identify algorithms, machine learning problems
2. gets ability to apply the knowledge of computing and mathematics appropriate to the discipline
3. Identifies various machine learning techniques such as decision tree, artificial neural networks, Bayesian learning, genetic algorithms, clustering and classification algorithms etc. and their applications
4. gets working knowledge of applying the ML algorithms to the available large data sets with the available simulation packages such as WEKA , Clementine etc.

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

Some Basic Statistics: Averages, Variance and Covariance, The Gaussian.
The Bias-Variance Tradeoff Bayesian learning: Introduction, Bayes theorem, Bayes Optimal Classifier, Naive Bayes Classifier.
Graphical Models: Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm.

UNIT-IV

Evolutionary Learning: Genetic Algorithms, Genetic Operators.

Genetic Programming Ensemble learning: Boosting, Bagging.

Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis

UNIT-V

Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison.

Suggested Reading:

1) Tom M. Mitchell, "Machine Leaming ",MacGraw Hill, 1997.
2) Stephen Marsland, "Machine Learning - An Algorithmic Perspective ", CRC Press, 2009.
3) Margaret H Dunham, "Data Mining", Pearson Edition, 2003.
4) GalitShmueli, Nitin R Patel, Peter C Bruce, "Data Mining for Business Intelligence", Wiley India Edition, 2007.
5) RajjallShinghal, "Pattern Recognition ", Oxford University Press, 2006.

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IT 6104

DISTRIBUTED SYSTEMS

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Course Objectives:

At the end of the course, student can

1. Learn the fundamental architectures and distributed system models
2. Understand principles of distributed systems.
3. UnderstandVarious security issues in distributed environment
4. Compare and analyze the differences between conventional and distributed transactions

Course Outcomes:

Upon successful completion of the course, student

1. Will be able to understand distributed client server paradigms.
2. Will be able to understand and develop distributed communication mechanisms like RPC and RMI.
3. Will be able to understand and develop distributed technologies like DCOM, GLOBE and CORBA.

UNIT – I

INTRODUCTION: Definition of A Distributed System; Goals- Making Resources Accessible, Distribution Transparency, Openness, Scalability, Pitfalls; 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, Discussion; Self-Management in Distributed Systems-The Feedback Control Model, Example: Systems Monitoring with Astrolabe, Example: Differentiating Replication Strategies in Globule, Example: Automatic Component Repair Management in Jade.

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.

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COMMUNICATION: Fundamentals- Layered Protocols, Types of Communication; Remote Procedure Call- Basic RPC Operation, Parameter Passing; Asynchronous RPC, Example: DCE RPC; Message-Oriented Communication- Message Oriented Transient Communication, Message Oriented Persistent Communication, Example: IBM'S WebSphere Message-Queuing System; Stream-Oriented Communication- Support for Continuous Media, Streams and Quality of Service, Stream Synchronization; Multicast Communication, Application-Level Multicasting, Gossip-Based Data Dissemination.

UNIT-III

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, Example: The Domain Name System; 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 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

SECURITY: Introduction to Security- Security Threats, Policies, and Mechanisms, Design Issues, Cryptography; Secure Channels- Authentication, Message Integrity and Confidentiality,

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Secure Group Communication, Example: Kerberos; Access Control- General Issues in Access Control, Firewalls, Secure Mobile Code, Denial of Service; Security Management- Key Management, Secure Group Management, Authorization Management.

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.

Suggested Reading:

1) Andrew S. Tanenbaum and Van Steen "Distributed Systems", Second Edition, PHI,2014
2) Colouris G., Dollimore Jean and Kindberg Tim, "Distributed Systems Concepts and Design", 3rd Edition, Pearson education, 2002.
3) SunithaMahajan, Seema Shah, “Distributed Computing”, SecondEdision, Oxford University Press, , 2013
4) Kai Hwang, GeofferyC.Fox, Jack J.Dongarra, “Distributed and Cloud Computing”, Morgan Kaufmann publishers, 2012.
5) S.Ghosh, Chapman & Hall/CRC, “Distributed Systems”, Taylor & Francis Group, 2010.
6) Ajay D. Kshemakalyani&MukeshSinghal, “Distributed Computing, Principles, Algorithms and Systems”, Cambridge, 2010.

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IT 6108

HUMAN COMPUTER INTERACTION

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Course objectives:

At the end of the course, student should be able to

1. design, evaluate and deploy usable, effective technologies
2. produce a low-fidelity prototype for an interactive product based upon a simple list of interaction design principles.

Course outcomes:

Upon successful completion of the course students can

1. Think constructively & analytically about how to design and evaluate interactive technologies.
2. determine the most appropriate HCI methods to meet the needs of a practical software development project

UNIT - I:

Interaction Paradigms: Computing Environments, Analyzing Interaction Paradigms, Interaction Paradigms.

Interaction Frameworks and Styles: Frameworks for Understanding Interaction, Coping with Complexity, Interaction Styles.

UNIT - II:

Interaction Design Process: Iterative Design, User-Centered Design, Interaction Design Models, Overview of Interaction Design Models.

Discovery: Discovery Phase Framework, Collection, Interpretation, Documentation.

Design: Conceptual Design, Physical Design, Evaluation, Interface Design standards, Designing the Facets of the Interface.

UNIT - III:

Design Principles: Principles of Interaction Design, Comprehensibility, Learnability, Effectiveness/Usefulness, Efficiency/Usability, Grouping, Stimulus Intensity, Proportion, Screen Complexity, Resolution/Closure, Usability Goals.

Interaction Design Models: Model Human Processor, Keyboard Level Model, GOMS,Modeling Structure, Modeling Dynamics, Physical Models.

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Usability Testing: Usability, Usability Test, Design the Test, Prepare for the Test, Perform the Test, Process the Data.

UNIT - IV:

Interface Components: The WIMP Interface, Other Components.

Icons: Human Issues Concerning Icons, Using Icons in Interaction Design, Technical Issues Concerning Icons.

Color: The Human Perceptual System, Using Color in Interaction Design, Color Concerns for Interaction Design, Technical Issues Concerning Color.

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UNIT - V:

Text: Human Issues Concerning Text, Using Text in Interaction Design, Technical Issues Concerning Text.

Speech and Hearing: The Human Perceptual System, Using Sound in Interaction Design, Technical Issues Concerning Sound.

Touch and Movement: The Human Perceptual System, Using Haptics in Interaction Design, Technical Issues Concerning Haptics.

Suggested reading:

1. Steven Heim, "The Resonant Interface: HCI Foundations for Interaction Design", Addison-Wesley, 2007.
2. J. Preece, Y. Rogers, and H. Sharp, "Interaction Design: Beyond Human-Computer Interaction", Wiley & Sons, 2nd Ed., 2007.
3. Ben Shneiderman ,Catherine Plaisant,"Designing the User Interface: Strategies for Effective Human-Computer Interaction", 5th edition, Addison-Wesley, 2009.

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IT 5131

SOFTWARE LAB- I
(CRYPTOGRAPHY AND NETWORKS)

Instruction	3 Periods per Week
Duration of University Examination	--
University Examination	--
Sessional	50 Marks

1. Implementation of Mono alphabetic cipher
2. Implementation of Vigenere cipher (Polyalphabetic substitution)
3. Implementation of Hill cipher and Gauss cipher
4. Implementation of S-DES algorithm for data encryption
5. Implement RSA asymmetric (public key and private key)-Encryption. Encryption key (e, n) & (d, n)
6. Generate digital signature using Hash code.
7. Generate digital signature using MAC code.
8. Study of MD5 hash function and implement the hash code using MD5.
9. Study of SHA-1 hash function and implement the hash code using SHA-1.
10. Design an Authentication application like Kerberos in C++ / JAVA.
11. Study and implement IP spoofing in TCP/UDP environment.
12. Attacks on Smart cards: A case study.

Note: Tools / Apparatus Required: O.S.: Microsoft Windows (any) / Linux
Packages: Turbo/Borland/GNU - C/C++

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IT 5132

SEMINAR – I

Instruction	3 Periods per Week
Duration of University Examination	--
University Examination	--
Sessional	50 Marks

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for systematic independent study of state of the art topics in broad area of his / her specialization.

Seminar topics can be chosen by the students with the advice from the faculty members. Students are to be exposed to following aspects of Seminar presentations.

Literature Survey
Organization of material
Preparation of PowerPoint presentation slides
Technical Writing

Each Student is required to

1. Submit one page of synopsis of the seminar talk two days before for display on notice board
2. Give 20 minutes of PowerPoint presentation followed by 10 minutes of discussion.
3. Submit a report on the seminar topic with a list of references and slides used within a week.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule should be discouraged.

The sessional marks will be awarded to the students by at least two faculty members on the basis of an oral and written presentation in addition to their involvement in the discussion.

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IT 6111

DATA HIDING

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Course objectives:

At the end of the course, student should be able to

1. Understand basic concepts of data hiding.
2. Understand basic concepts of digital water marking.
3. Understand basic concepts of steganography.

Course outcomes:

Upon successful completion of the course students can

1. Understand difference between data hiding and cryptography.
2. Design and develop digital water marking system.
3. Design and develop steganography system.

UNIT – I

Introduction: Applications and Properties, Models of Watermarking – Notation, Communications, Communication based Models of Watermarking, Geometric Models of Watermarking, Modeling Watermark Detection by Correlation.

UNIT – II

Basic Message Coding, Watermarking with Side Information: Informed Embedding, Watermarking Using Side Information, Dirty-Paper Codes, Practical Dirty-Paper Codes.

UNIT – III

Analyzing Errors: False Positive and Negative Errors, ROC Curves, The Effect of Whitening on Error Rates, Analysis of Normalized Correlation, Using Perceptual Models- Evaluating Perceptual Impact of Watermarks, General Form of a Perceptual Model - Examples, Perceptually Adaptive Watermarking.

UNIT – IV

Robust Watermarking: Approaches, Robustness to Volumetric Distortions, Robustness to Temporal and Geometric Distortions, Watermark Security- Security Requirements, Watermark Security and Cryptography, Some Significant Known Attacks, Content Authentication- Exact Authentication, Selective Authentication, Localization, Restoration.

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UNIT – V

Steganography: Steganographic Communication, Notation and Terminology, Information-Theoretic Foundations of Steganography, Practical Steganographic Methods, Minimizing the Embedding Impact,Steganalysis-Steganalysis Scenarios, Steganalysis Algorithms.

Suggested Reading:

1) Ingemar Cox, Matthew Miller, Jeffrey Bloom, Jessica Fridrich, Ton Kalker, "Digital Watermarking and Steganography", 2^{nd} Edition, Morgan Kaufmann, 2007.
2) Michael T. Raggo and Chet Hosmer, "Data Hiding: Exposing Concealed Data in Multimedia, Operating Systems, Mobile Devices and Network Protocols", 1^{st} Edition, Syngress, 2012.

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IT 6112

ELECTRONIC COMMERCE

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Course objectives:

At the end of the course, student should be able to

1. To understand the concept of e-Commerce;
2. To understand the applications of e-Commerce;
3. To understand the security issues of e-Commerce
4. To understand the role of multimedia in e-Commerce

Course outcomes:

Upon successful completion of the course students can

1. Able to use e-commerce in business applications
2. To resolve security issues in Electronic Payment Systems
3. To make effective use of multimedia in E-commerce applications

UNIT-I

Electronic Commerce: Electronic Commerce Frame Work, Electronic Commerce and Media Convergence, Anatomy of E-Commerce appellations, Electronic Commerce Consumer applications, Electronic Commerce Organization Applications.

Consumer Oriented Electronic Commerce: Consumer- Oriented Applications, Mercantile Process Models, Mercantile Models from the Consumer's Perspective, Mercantile Models from the Merchants' Perspective.

UNIT-II

Electronic Payment systems: Types of Electronic Payment Systems, Digital Token - Based Electronic Payment Systems, Smart Cards Electronic Payment Systems, Credit Card- Based Electronic Payment Systems, Risk and Electronic Payment systems, Designing Electronic Payment Systems.

UNIT -III

Inter Organizational Commerce and EDI: Electronic Data Interchange, EDI applications in business, EDI: Legal, Security, and Privacy issues, EDI and Electronic Commerce. EDI Implementation, MIME and Value added networks.-Standardization and EDI, EDI Software Implementation, EDI Envelope for Message Transport, Value-Added Networks, Internet-Based EDI.

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Intra organizational Electronic Commerce: Internal Information Systems, Work Flow Automation and Coordination, Customization and internal Commerce, Supply chain Management.

UNIT-IV

Corporate Digital Library: Dimensions of Internal electronic Commerce Systems, Types of Digital Documents, Issues behind Document Infrastructure, Corporate Data Warehouse Advertising and Marketing on the Internet - Information based marketing, advertising on Internet, on-line marketing process, market research.

UNIT -V

Consumer Search and Resource Discovery: Search and Resource Discovery paradigms, Information search and Retrieval, Electronic Commerce catalogues or Directories, information filtering, Consumer-Data Interface, Emerging Tools.

Multimedia and Digital video: key multimedia concepts, Digital Video and Electronic Commerce, Desktop video processing, Desktop video conferencing.

Suggested Reading:

1) Ravi Kalakota& A. B. Whinstong: "Frontiers of Electronic Commerce", Pearson Education, lndia, 2006.
2) Daniel Minoli, Emma Minoli, “Web Commerce Technology Handbook” Tata McGraw Hill 2007.
3) J Christopher W, Theodore HKC, "Global Electronic Commerce: Theory and Case Studies", Universities Press, 2001.

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IT 6117

MOBILE ADHOC AND SENSOR NETWORKS

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

CourseObjectives:

At the end of the course, student should be able to

1. To understand the concepts of wireless LANs, PAN, mobile adhoc networks and sensor networks
2. To understand the components of mobile IP and mobility management.
3. To understand proactive, reactive and hybrid classes of routing approaches

Course Outcomes:

After successful completion of the course, student will be able to

1. Identify layers of Wi-Fi, Bluetooth and their functions
2. Describe the principles of mobile adhoc networks and explain how the 3 classes of routing protocols function
3. Identify the components and the role of each component of wireless sensor networks

UNIT - I

Introduction- Issues in Mobile computing, Overview of wireless telephony: Cellular concept, GSM, System Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Handover, Security, GPRS.

Wireless LAN – IEEE 802.11 Standards, Architecture, services, HIPERLAN, AdHoc Network, Blue Tooth.

UNIT - II

Mobile IP – Dynamic Host Configuration Protocol, Routing : DSDV, DSR, AODV, ZRP, TCP over Wireless Networks: Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit /Fast Recovery, Transmission/Timeout Freezing, SelectiveRetransmission, Transaction Oriented TCP

WAP: WAP Architecture, WDP, WTLS, WTP, WSP, WML, WML Script, WAE, WTA.

UNIT - III

Introduction to Ad-hoc Networks: Characteristics of MANETs, Applications of MANETs and challenges of MANETs.

Routing in MANETs: Criteria for classification, Table Driven Routing Protocols, Source Initiated On-Demand Routing Protocols, Hybrid Protocols – Zone Routing, Fisheye Routing, LANMAR for MANET with group mobility, Location Added Routing, Distance Routing Effects, Micro discovery and Power Aware Routing.

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UNIT - IV

Data Transmission: Broadcast storm problem, Broadcasting.

Multicasting and Geocasting - TCP over Ad-Hoc: TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc networks.

QoS Issues in Ad-hoc Networks: QoS parameters in Ad-hoc networks, Issues and challenges in providing QoS in Ad-hoc Wireless networks, Classification of QoS solutions, MAC layer and Network Layer solutions.

UNIT - V

Basics of Sensors and Applications: Architecture of wireless sensor networks, Mica mote, sensing and communication range, design issues, energy consumption, classification of wireless sensor networks, Routing layer, Transport layer, High-level application layer support.

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Suggested Reading:

1) Jochen Schiller, “Mobile Communications”, Second Edition, Prentice Hall of India, Pearson Education, 2003.
2) William Stallings, “Wireless Communications and Networks”, Second Edition, Prentice Hall of India, Pearson Education, 2004.
3) UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, New York, 2003.
4) PrasantMohapatra and Srihanamurthy, “Ad-Hoc Networks Technologies and Protocols”, Springer, Springer International Edition, 2009.
5) Siva Ram Murthy and B. S. Manoj, “Ad-Hoc Wireless Networks: Architectures and Protocols”, Pearson Education, Inc., 2005.
6) KazemSohraby, Daniel Minoli, TaiebZnati, “Wireless Sensor Networks”, A John Wiley & Sons, Inc., Publication, 2007.
7) Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, 2005.
8) Feng ZHAO. Leonidas GUIBAS, “Wireless Sensor Network-An Information Processing Approach”, Morgan Kaufmann Publishers, Elsevier.

IT 6122

BIOMETRIC SECURITY

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Objectives:

1. To provide students with understanding of biometrics, biometric equipment and standards applied to security.
2. To introduce biometric computing knowledge and methods
3. To learn some basic biometrics systems with real case studies

Outcomes:

After the course is completed student should be able to:

1. Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
2. Understand and analyze biometric systems at the component level and be able to analyze and design basic biometric system applications.
3. Identify various issues associated with the design and implementation of biometric systems.

UNIT - I

Introduction: Person Recognition, Biometric Systems, Biometric Functionalities, Biometric System Errors, The Design Cycle of Biometric Systems, Applications, Security and Privacy Issues.

UNIT - II

Fingerprint recognition: Introduction, Friction Ridge Pattern, Fingerprint Acquisition, Feature Extraction, Matching, Fingerprint Indexing, Fingerprint Synthesis, Palmprint.

Face Recognition: Introduction, Image Acquisition, Face Detection, Feature Extraction and Matching.

UNIT - III

Iris Recognition: Introduction, Design of an Iris Recognition System, Image Acquisition, Iris Segmentation, Iris Normalization, Iris Encoding and Matching, Iris Quality, Performance Evaluation.

UNIT - IV

Additional Biometric Traits: Introduction, Ear, Gait, Hand Geometry, Soft Biometrics.

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Multibiometrics: Introduction, Sources of Multiple Evidence, Acquisition and Processing Architecture Fusion Levels.

UNIT- V

Security of Biometric Systems: Introduction, Adversary Attacks, Attacks at the User Interface, Attacks on Biometric Processing, Attacks on the Template Database.

Suggested Reading:

1) Anil K. Jain, Arun A. Ross,KarthikNandakumar, "Introduction to Biometrics", Springer Science Business Media, LLC 2011.
2) James Wayman, Anil Jain, DavideMaltoni, and Dario Maio (Eds) "Biometric Systems
3) Technology, Design and Performance Evaluation",Springer-Verlag London Limited 2005.
4) Julian Ashbourn,"Guide to Biometrics for Large-Scale Systems Technological, Operational,
5) and User-Related Factors" Springer-Verlag London Limited 2011.
6) "Securing Biometrics Applications"by Charles A. Shoniregun and Stephen Crosier Springer.

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IT 6127

WEB MINING

Instruction	3 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Objectives:

1. Introduce students to the basic concepts and techniques of Information Retrieval, Web Search, Machine Learning for extracting knowledge from the web.
2. Develop skills of using recent data mining software for solving practical problems of Web Mining.
3. Gain experience of doing independent study and research.

Outcomes:

After the course is completed student should be able to:

1. Describe key concepts such as web log, hypertext, social network, information synthesis, corpora and evaluation measures such as precision and recall.
2. Discuss the use of methods and techniques such as word frequency and co-occurrence statistics, normalization of data, machine learning, clustering and vector space models.
3. Analyze and explain what web mining problems are satisfiably solved, what is worked upon at the research frontier and what still lies beyond the current state-of-the-art.

UNIT-I

Introduction: Crawling and Indexing, Topic Directories, Clustering and Classification, Hyperlink analysis, Resource Discovery and Vertical Portals. Structured vs Unstructured Data Mining.**Crawling the web:** HTML and HTTP basics, Crawling Basics, Engineering Large Scale Crawlers, Putting Together a Crawler.

UNIT-II

Web Search and Information Retrieval: Boolean Queries and Inverted index, Relevance Ranking, Similarity Search.

Similarity and Clustering: Foundations and Approaches, Bottom-up and Top-Down partitioning paradigms.

UNIT-III

Supervised learning: Introduction, Overview of classification strategies, Nearest Neighbor Learners, Feature Selection, Bayesian Learners, Discriminative Classification, Hypertext Classification.

UNIT-IV

Semi supervised learning: Expectation Maximization, Labelling Hypertext Graphs, Co-Training

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Social network analysis: Social Sciences and bibliometry, Page Rank and HITS, Coarse Grained Graph, Model, EnhancedModel and Techniques, Evaluation of Topic Distillation.

UNIT-V

Resource discovery: Collecting Important Pages, Similarity Search using Link Topology, Topical Locality and Focused Crawling, Discovering Communities.

Future of Web Mining: Information Extraction, Natural Language Processing, Question Answering, Profile, Personalization and Collaboration.

Suggested Reading:

1) ChakrabartiSoumen, "Mining the Web: Discovering Knowledge from Hypertext Data ", Morgan Kaufmann Publishers, 2003.
2) Manu Konchady, "Text Mining Application Programming" Cengage Learning, 2006.

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IT 5142

SEMINAR – II

Instruction	3 Periods per Week
Duration of University Examination	--
University Examination	--
Sessional	50 Marks

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for systematic independent study of state of the art topics in broad area of his / her specialization.

Seminar topics can be chosen by the students with the advice from the faculty members. Students are to be exposed to following aspects of Seminar presentations.

Literature Survey
Organization of material
Preparation of PowerPoint presentation slides
Technical Writing

Each Student is required to

1. Submit one page of synopsis of the seminar talk two days before for display on notice board
2. Give 20 minutes of PowerPoint presentation followed by 10 minutes of discussion.
3. Submit a report on the seminar topic with a list of references and slides used within a week.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule should be discouraged.

The sessional marks will be awarded to the students by at least two faculty members on the basis of an oral and written presentation in addition to their involvement in the discussion.

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16MT C01

ENGINEERING MATHEMATICS – I

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

Course Objectives:

1. To solve Linear System of Equations using Matrix Methods
2. To Know the Partial Derivatives and use them to interpret the way a function of two variable behaves
3. To analyse the Shape of the Graph of a given Curve
4. To Evaluate Double and Triple integrals of various functions and their significance
5. Formulate and solve the Differential Equations of First Order
6. To know the methods to solve real life problems.

Course outcomes: On the successful completion of this course student shall be able to

1. Solve system of linear equations and identify the Eigen values and Eigen vector in engineering problems
2. Expand and find extreme values of functions of two variables
3. Trace and interpret curve behavior in physical systems
4. Find the areas, volumes and surface of solids revolution
5. Use-differential equations to model engineering phenomena such as circuit theory, networks
6. An ability to solve the problems and interpret it in geometrical approach

UNIT- I

Linear Algebra: Review of Rank & Consistency, Eigen values, Eigen vectors- properties (without proofs). Cayley- Hamilton Theorem (statement only) inverse and powers of a Matrix by Cayley-Hamilton Theorem. Reduction of Quadratic form to Canonical form by linear transformation, rank, positive, negative, definite, semi-definite, index and signature

UNIT- II

Functions of several variables: Partial differentiations, Homogenous function, Euler's theorem, Implicit functions, Jacobins, Taylor"s series in one and two variables, Maxima and Minima for function of two variables with and without constraints

UNIT- III

Differential Calculus: Curvature and Radius of curvature centre of curvature, circle of curvature. Evolutes, involutes and Envelopes, Curve tracing-Cartesian, polar and parametric curves

UNIT- IV

Multiple Integrals: Double Integrals, Triple Integrals, Change of order of Integration, Applications of integration, rectification, areas, volumes and surfaces of solids of revolution in Cartesian coordinates, Centre of Gravity, PAPPUS theorem.

UNIT- V

First order differential equations and its application: Exact differential equations, Orthogonal trajectory's, Electrical circuits, Newtons law of cooling

Text Books:

1. Ervin Kreyszig "Advanced Engineering " 10 Edition, john wiley & sons -publishers
2. A R.K.Jain&S.R.K.Iyenger "Advanced Engineering Mathematics" , 3rd edition, Narosa Publications
3. AlenJaffery "Mathematics for Engineers and Scientists", 6th edition : CRC press, Taylor & Francis Group.(Elsevier),2013

Suggested Reading:

1. Kanti.B.Datta "Mathematical Methods of science and engineering", Aided with MATLAB, .Cengage Learning India Pvt. Ltd, Pratapgang ,New Delhi
2. B.S.Grewal "Higher Engineering Mathematics" , Khanna Publishers
3. William E.Boyce /Richard C.Dip "Elementary differential equations" , 9th Edition

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16CY C01

ENGINEERING CHEMISTRY

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives

The syllabus has sought to fulfill the objective of making the student of engineering and technology realize that chemistry is the real base of his profession and that therefore he must have a good understanding of chemistry before he can use it in his profession.

“ the study of chemistry is profitable not only in as much as it promotes the material interest of mankind ,but also because it furnishes us with insight into the wonders of creation , which immediately surround us and with which our existence, life and development, are most closely connected.” Justus Von Leibig (German Chemist)

The various units of the syllabus is so designed to fulfill the following objectives.

1. This syllabus helps at providing the necessary introduction of the chemical principles involved and devices in a comprehensive manner understandable to the students aspiring to become practicing engineers.
2. The aim of framing the syllabus is to impart intensive and extensive knowledge of the subject so that students can understand the role of chemistry in the field of engineering.
3. Thermodynamics and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. Fuels have been taught with a view to give awareness as to materials which can be used as sources of energy
5. To understand importance of analytical instrumentation for different chemical analysis.

Course Outcome

1. This syllabus gives necessary theoretical aspects required for understanding intricacies of the subject and also gives sufficient exposure to the chemistry aspects in different disciplines of engineering
2. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.
3. This syllabus imparts a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

UNIT – I

Chemical Thermodynamics : Introduction and definition of the terms, the concept of reversible and irreversible processes, Work done in isothermal and adiabatic processes, Success and limitations of First law of thermodynamics, need for second law of thermodynamics, statements of second law of thermodynamics, Carnot cycle, heat engine and its efficiency, Carnot theorem, concept of Entropy - Entropy changes in reversible and irreversible processes, physical significance of entropy criteria of spontaneity in terms of entropy and Gibb’s free energy function , Gibb’s-Helmholtz equation and applications, Numericals.

UNIT – II

Phase rule & Chemical Equilibria

Phase rule : Statement , definition of the terms - phases, components , degrees of freedom with examples, Phase diagram - one component system (water system), two component system (siver-lead system) , desilverisation of lead.

Chemical Equilibria - Homogenous and Heterogenous Equilibria - applications

UNIT – III

Fuels: Classification, requirements of a good fuel, calorific value, types of calorific value, calculation of CV using Dulong’s formula, Combustion - calculation of air quantities by weight and volume, Numericals.

Solid fuels: coal - analysis of coal – proximate and ultimate analysis - importance.

Liquid fuels - crude oil - fractional distillation, cracking - Fixed bed catalytic cracking, knocking, antiknocking agents (TEL, MTBE), octane number, cetane number, unleaded petrol.

Gaseous fuels - LPG, CNG - composition and uses

UNIT – IV

Electrochemistry Introduction, construction of electrochemical cell, sign convention, cell notation, cell emf, SOP and SRP, electrochemical series and its applications, Nernst equation and applications, Types of Electrodes - Standard Hydrogen Electrode, Saturated Calomel Electrode, Quinhydrone electrode and Ion selective electrode (Glass electrode), construction, Numericals

UNIT –V

Instrumental Techniques in Chemical Analysis: Principle, method and applications of Conductometry (acid-base titration), Potentiometry (acid-base, redox titration), pH- metry (acid – base titration), Colorimetry (Beer Lambert’s law)

Green Chemistry - outlines and Principles

Text Books:

1. P.C.Jain and Monica Jain, “Engineering Chemistry”, Dhanpat Rai Pub, Co., New Delhi (2002)
2. Puri & Sharma, “Principles of Physical Chemistry
3. S.S.Dara & S.S.Umare, “Engineering Chemistry”, S.Chand company
4. J.C. Kuriacase & J. Rajaram, “Chemistry in engineering and Technology”, Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
5. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
6. P.R.Vijayasarathi, “Engineering Chemistry” PHI Learning Private Limited, New Delhi (2011)

Suggested Reading:

1. Physical chemistry by P.W.Atkin (ELBS OXFORD PRESS)
2. Physical chemistry by W.J.Moore (Orient Longman)
3. Physical Chemistry by Glasstone
4. Physical Chemistry by T.Engel & Philip Reid, Pearson Publication.
5. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd.,Meerut (2001).

16PY C02

APPLIED PHYSICS

Instruction	2L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	20 Marks
Credits	2

Course Objectives: The objectives of the course is to make the student
1. Learn the concepts of modern physics
2. Gain knowledge of wave mechanics and statistical mechanics
3. Know the different kinds of materials and their characterization techniques

Course Outcomes: At the end of the course, the student will be able to
1. Understand the advances in laser physics, holography, optical fibers and apply them in engineering & technology
2. Explain the importance of wave mechanics and band theory of solids
3. Analyze and apply distributions of statistical mechanics for problem solving
4. Identify the materials with semiconducting and superconducting properties for engineering applications
5. Understand the role of novel materials and their characterization techniques in engineering and technology

UNIT – I

Lasers &Holography: Characteristics of lasers – Spontaneous & stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – He-Ne laser – Semiconductor laser – Applications. Basic principle of Holography – Recording & Reconstruction of hologram – Applications

Optical Fibers: Principle and Construction – Propagation of light through an optical fibre – Acceptance angle – Numerical aperture – Pulse dispersion – Classification of optical fibers: Single mode & Multi mode and Step-index & Graded-index optical fibers – Double crucible method – Applications.

UNIT – II

Wave Mechanics: Schrödinger time independent and time dependent wave equations – Physical significance of wave function – Infinite square well potential (particle in a box) – Potential barrier – Tunneling effect .

Band Theory of Solids: Origin of energy band formation – Electron in periodic potential – Kronig-Penny model (qualitative) – Classification of solids

UNIT – III

Elements of Statistical Mechanics: Maxwell-Boltzmann statistics – Bose-Einstein statistics – Fermi-Dirac statistics – Photon gas – Planck's' law of black body radiation – Wien's law and Rayleigh-Jean's law from Planck's law – Concept of electron gas (qualitative) – Fermi energy level.

UNIT – IV

Semiconductors: Intrinsic and extrinsic semiconductors – Carrier concentration in intrinsic semiconductors – Energy gap – Hall Effect – Construction & working of solar cell.

Superconductors: General properties of superconductors – Meissner's effect – Type I and Type II superconductors – BCS theory (qualitative) – Applications.

UNIT – V

Nanomaterials: Properties of materials at reduced size – Surface to volume ratio – Quantum confinement –Preparation of nanomaterials: Bottom-up approach (Sol-gel method) & Top-down approach (Ball milling method) – Elementary ideas of carbon nanotubes – Applications of nanomaterials.

Techniques for Characterization of Materials: X-ray fluorescence – Auger (OJ) process – Scanning electron microscope (SEM) – Tunneling electron microscope (TEM) – Atomic force microscope (AFM).

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 Engineering Physics", S. Chand Publications, 2014.
3. Satya Prakash, "Statistical Mechanics", Kedar Nath Ram Nath Publications, 2008.
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. M. Arumugam, "Materials Science", Anuradha Publications, 2015.
3. P.K. Palanisamy, "Engineering Physics", Scitech Publications, 2012.
4. Hitendra K Malik and A.K. Singh, "Engineering Physics", Tata McGraw Hill Education Publications, 2011

16CS C01

PROGRAMMING AND PROBLEM SOLVING

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

Course Objective:
1. To acquire problem solving Skills.
2. To be able to write Algorithms.
3. To understand structured programming Approach.
4. To understand Memory structure.
5. To implement I/O Programming.
6. To be able to write program in C Language.

Course Outcomes: Student will be able to:
1. Develop algorithms for scientific problems.
2. Explore algorithmic approaches to problem solving.
3. Understand the components of computing systems.
4. Choose data types and structure to solve mathematical problem.
5. Develop modular programs using control structure, arrays and structures.
6. Write programs to solve real world problems using structured features.

UNIT – I
Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts.
Introduction to C Language: Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

UNIT – II
Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do-While and Examples. Continue, Break and goto statements.
Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Parameter Passing-Call-by-value, call-by-reference, Recursion**.**

UNIT – III
Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.
Arrays: Concepts, Using Arrays in C, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays.
Searching and Sorting: Linear and Binary Search, Selection Sort and Bubble Sort.

UNIT – IV
Pointers: Introduction, Pointers to Pointers, Compatibility, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command-line Arguments.
Strings: Concepts, String Input /Output Functions, Arrays of Strings, String Manipulation Functions.

UNIT – V
Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Unions, Type Definition (typedef), Enumerated Types.
Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/output Functions, Character Input/output Functions
Preprocessors: Preprocessor Commands.

Text Books:

1. Pradip Dey and Manas Ghosh “Programming in C 2/e” Oxford University Press , 2nd Edition 2011.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language” Prentice Hall India, 2nd Edition. 1990.
3. B.A.Forouzan and R.F. Gilberg A Structured Programming Approach in C, Cengage Learning,2007.

Suggested Reading:

1. Rajaraman V. "The Fundamentals of Computers" 4th Edition, Prentice Hall of India, 2006.
2. R S Bichker “programming in c” University Press ,2012.

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16ME C01

ELEMENTS OF MECHANICAL ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. Student will understand different types of engineering materials and their applications.
2. Student will come to know working principles of Petrol & Diesel engines with basic knowledge of thermodynamics.
3. Student will understand various making processes.
4. Student will come to know various power transmission devices.
5. Student will understand the importance of principles of management in industry.
6. Student will come to know aspects of various quality control techniques.

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

1. Select the material depending upon requirement.
2. Evaluate performance of Petrol & Diesel engines.
3. Demonstrate his/her knowledge in preparing process chart for various machining operations.
4. Estimate the power required for various power transmitting devices like belt and gear trains.
5. Become a successful entrepreneur after studying principles of management.
6. Apply various quality control techniques after studying principles of industrial engineering.

UNIT – I

Engineering Materials: Metals and their alloys, Ductile and brittle materials, Ceramics, Polymers, Composite materials
Simple Stresses & Strains: Stress-strain diagram (for ductile and brittle materials), Poison's ratio, Young's Modulus, Rigidity modulus, Bulk modulus, Failure theories, factor of safety.

UNIT – II

Thermodynamics: Zeroth, First, Second and Third laws of thermodynamics and corollaries
I.C. Engines: Working principle of Two stroke and Four stroke SI and CI engines, Calculations of efficiencies
Heat Transfer: Fourier law of conduction in single coordinates, Newton's law of conduction, Stephens & Boltzmann law of radiation

UNIT – III

Basic Manufacturing Processes: Introduction to Welding, Brazing & Soldering, Principles of gas welding & arc welding processes, Casting, Principles of sand casting and die casting, Principles of Turning, Drilling, Milling, Grinding, Knurling, Tapping and Honing operations

UNIT – IV

Kinematics: Definitions of kinematic link, pair, mechanism and machine
Gear Trains: Simple, Compound, Inverted and Epicyclic gear trains
Belt Drives: Open and crossed belt drives, length of belts, ratio of belt tensions for flat belt, condition for maximum power transmission for flat belt
Fluid Mechanics: Definition and basic properties of fluids, types of fluids and fluid flows, stream lines, streak lines, stream function and velocity potential

UNIT – V

Industrial Engineering & Management: Introduction to scientific management, basics and importance of work study, steps in conducting work study, time study, standard time, organization and types of organization, Quality definition and its importance, introduction to quality control, types of inspection.

Text Books:

1. Jonathan Wickert and Kemper E. Lewis, An Introduction to Mechanical Engineering,3rd Ed, Cengage learning, USA, 2013
2. Yunus A. Cengel, Heat Transfer: A Practical Approach, Mcgraw-Hill, 2nd edition, 2002
3. Mahesh M Rathore, Thermal Engineering, Tata Mc Grw Hill Eduation Pvt. Ltd., 2010

Suggested Reading:

1. R K Rajput, Thermal Engineering, Laxmi Publications, 2010
2. Michael Geoffrey Stevenson, Industrial Engineering, University of N.S.W., Division of Postgraduate Extension Studies, 1972
3. PN Rao, Manufacturing Technology, Volume-I, 3rd Edition, Tata McGraw-Hill, Education, 2009
4. Thomas Bevan, Theory of Machines, 3rd Edition, Pearson Education India, 1986
5. P. N. Modi, S. M. Seth, Hydraulics and Fluid Mechanics: Including Hydraulic Machines, Standard Book House, 2011

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16EC C01

ELEMENTS OF ELECTRONICS AND COMMUNICATION ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To understand the elementary concepts of electronic devices.
2. To study basics of Boolean algebra and working of digital circuits.
3. To understand basic operations of AM, FM, filters and multiplexing .
4. To enable the students to understand the working of commonly used communication systems.
5. To give an exposure to the selected applications.

Course Outcomes: The students will be able to

1. Familiar with the basic electronic devices and simple circuits
2. Work with Boolean algebra principles, build the simple combinational and sequential circuits
3. Appreciate the need for modulation, filtering and multiplexing
4. Understand the working principles of a few communication systems
5. Familiar to the selected applications

UNIT – I

Basics of Passive and Active devices

Classification of passive and active devices and their symbols; current flow in a semiconductor; Operating principle of a diode, its application as a rectifier; Operating principle of a transistor (BJT and JFET), Principle and use of Zener diode, Photo diode and LED.

UNIT-II

Introduction to Digital Electronics

Number systems, Binary addition and subtraction, ASCII code, Boolean algebra (Theorems and properties), Logic gates, Combinational circuits such as Half adder, Full adder and Half subtractor, Introduction to sequential logic, Basic Flip flop, Evolution of ICs, block diagram description of Microprocessor and Microcontroller.

UNIT – III

Principles of Communication Engineering (Elementary treatment only)

Basic Communication system components; Concept of Modulation, Introduction to AM, FM and comparisons; Introduction to wired and wireless communication; Concepts of filtering, LPF, HPF, BPF and BSF; concept of multiplexing, TDM and FDM.

UNIT-IV

Overview of Communication systems

Radio spectrum and applications, Modes of propagation;
Basic cellular network and concepts of a cell, frequency reuse, hand-off and cross-talk;
Basic Radar block diagram and applications; Introduction to communication satellite, Geostationary satellites and subsystems, Applications of satellites, GPS, DTH, Remote Sensing;

UNIT –V

Basic operating principles of selected applications:

Block diagram of CRO and application; Software Defined Radio (SDR)-Definition and it's block diagram; Smart phone-features; Introduction to Wireless sensor networks (Bluetooth and ZigBee), RFID-and its types, basic functions; Introduction to Modem.

Text Books:

1. "Electronic Principles" by Albert Malvino and David J Bates, 7th Edition, 2006
2. "Digital Priniciples and Applications", by Donald P Leach, Albert Paul Malvino, Gautham saha, Tata McGraw Hill,6th Edition,2009
3. "Electronic Communication Systems", by Kennedy and Davis, Tata Megra Hill Publications, 4th Edition, 2008

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16CE C03

PROFESSIONAL ETHICS AND HUMAN VALUES

Instruction	1L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	- - -
Credits	1

Course Objectives:
1. To develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. To enable the students, understand the values, the need for value adoption and prepare them meet the challenges
3. To enable the students, develop the potential to adopt values, develop a good character and personality and lead a happy life
4. To motivate the students, practice the values in life and contribute for the society around them and for the development of the institutions /organisation around they are in.
5. To make the students understand the professional ethics and their applications to engineering profession

Course Outcomes:
1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, convert everything into happiness and contribute for the happiness of others.
4. Students become potential sources for contributing to the development of the society around them and institutions/ organisations they work in.
5. Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

UNIT-I Concepts and Classification of Values –Need and challenges for value Adoption -Definition of Values – Concept of Values – Classification of Values – Hierarchy of Values – Types of Values – Interdependence of Values
Need for value education – Lack of education in values – Benefits of value education- Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges

UNIT – II: Personal Development and Values in Life
Personal Development: – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity - Integrating values in everyday life

UNIT – III: Practicing Values for the development of Society
Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atrocities – Working for the Sustainable development of the society
Principles of Integrity-Institutional Development - Vision for better India.

UNIT – IV: Basic Concepts of Professional Ethics
Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional Ethics, Ethical dilemmas, Science – Religion - Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities like Sri.M.Visweshwarayya, Dr.APJ Abdul Kalam and JRD Tata

UNIT-V: Ethics in Engineering Profession
Engineering Profession-Technology and Society- Ethical obligations of Engineering Professionals-Role and responsibility of Engineers - A few Case Studies on Risk management safety and Risk Management
Plagiarism-Self plagiarism- -Ethics Standards and Bench Marking

Text Books:

1. Subramanian R, “ Professional Ethics “ , Oxford University Press , 2013
2. Nagarajan R S, “ A Text Book on Human Values and Professional Ethics “ New Age Publications , 2007
3. Dinesh Babu S, “ Professional Ethics and Human Values “ , Laxmi Publications , 2007

Suggested Reading:

1. SantoshAjmera and Nanda Kishore Reddy , “Ethics , Integrity and Aptitude”,McGrawhill Education Private Limited, 2014
2. Govinda Rajan M, Natarajan S, Senthil Kumar V S,“Professional Ethics and Human Values”, Prentice Hall India, Private Limited,2012
3. Course Material for Post Graduate Diploma In “Value Education & Spirituality” Prepared by Annamalai University in Collaboration with Brahma Kumaris, 2010

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16CS C02

PROGRAMMING LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

1. Demonstration of control structures.
2. Demonstration of switch case (menu driven).
3. Demonstration of Parameter passing Methods.
4. Demonstration of Functions using Recursion.
5. Demonstration of arrays Operations on Matrix.
6. Implementation of bubble sort.
7. Implementation of selection sort.
8. Implementation of Linear and Binary Search.
9. Implementation of string manipulation operations with and without library function.
10. Demonstration using Pointers.
11. Demonstration of Array of Structures.
12. Sequential file operations.

Text Books:

1. Pradip Dey and Manas Ghosh "Programming in C 2/e" Oxford University Press , 2nd Edition 2011.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language" Prentice Hall India, 2nd Edition. 1990.

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16ME C03

MECHANICAL AND IT WORKSHOP

Instruction	3P Periods per week
Duration of End Examination	3 Hours
End Examination	50 Marks
Sessional	25 Marks
Credits	2

Trades for Practice 1. Fitting 2. Tin Smithy 3. Carpentry 4. House Wiring Exercises in Fitting

1. To make a perfect rectangular MS flat
2. To do parallel cuts using Hack saw
3. To drill a hole and tap it
4. To make male and female fitting using MS flats-Assembly1
5. To make male and female fitting using MS flats-Assembly2

Exercises in Tin smithy

1. To make a square tray from the given sheet metal.
2. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
3. To make a scoop.
4. To make a dust pan from the given sheet metal.
5. To make a pamphlet box.

Exercises in Carpentry

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

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

Demonstration of plumbing and welding trades .

Note: ***A minimum of 12 exercises from the above need to be done***

References:

1. Workshop Technology -- Hazra chowdary

IT Workshop

List of Tasks:

Task 1: MS Word: Formatting text, inserting images, tables, equations and hyperlinks
Document Management: Page layout techniques and printing
Task 2: MS Excel: Functions and formulas and graph plotting
Task 3: MS Power point presentation: Guidelines for effective presentation, inserting objects, charts, hyperlinks and navigation between slides
Task 4: Essentials Search Engines & Net etiquette, Plagiarism, Open source tools and other utility tools

Suggested Reading:

1. Scott Mueller’s Upgrading and Repairing PCs, 18/e, Scott. Mueller, QUE, Pearson, 2008.
2. The Complete Computer upgrade and repair book, 3/e, Cheryl A Schmidt, Dreamtech

16PY C04

APPLIED PHYSICS LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives: The objectives of the course is to make the student
1. Acquire knowledge in experiments of modern physics
2. Understand the characteristics of various semiconductor devises
3. Work with lasers and optical fibers

Course Outcomes: At the end of the course, the student will be able to
1. Understand the various applications of semiconductor devices and their suitability in engineering
2. Demonstrate the working of lasers and optical fibers and their applications in the field of communication
3. Analyze the electrical properties of a given solid based on its energy band gap
4. Verify the resistance and thermoelectric power properties with temperature variation
5. Demonstrate the concept of electron and its charge experimentally

List of Experiments:
1. Planck's Constant – Determination of Planck's Constant using photo cell
2. Solar Cell – Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance
3. Hall Effect– Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen
4. P-N Junction Diode – Study of V-I characteristics and calculation of resistance of given diode in forward and reverse bias
5. Laser – Determination of wavelength of given semiconductor red laser
6. Fibre Optics – Determination of NA and power losses of given optical fibre
7. Energy Gap – Determination of energy gap of given semiconductor
8. Thermistor – Determination of temperature coefficient of resistance of given thermistor
9. *e/m* of Electron by Thomson's Method
10. Thermoelectric Power – Determination of thermoelectric power of given sample

Note: A student must perform a minimum of eight experiments.

Suggested Reading:

1. "Applied Physics"- Manual by Department of Physics, CBIT, 2016
2. S.K. Gupta, "Engineering Physics Practical", Krishna's Educational Publishers, 2014
3. O.P. Singh, V. Kumar and R.P. Singh, "Engineering Physics Practical Manual", Ram Prasad & Sons Publications, 2009

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16CY C03

ENGINEERING CHEMISTRY LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory
2. For practical understanding of theoretical concept of chemistry

Course Outcomes:

1. This syllabus helps the student to understand importance of analytical instrumentation for different chemical analysis.
2. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.

List of Experiments:

1. Introduction to chemical analysis.
2. Preparation of standard solution of oxalic acid and Standardization of NaOH
3. Estimation of amount of Fe^{+2} in the given solution using Mohr's salt and $KMnO_4$
4. Estimation of amount of Fe^{+2} in the given solution using Mohr's salt and $K_2Cr_2O_7$
5. Estimation of amount of copper in the given solution using hypo solution.
6. Estimation of amount of HCl pH metrically using NaOH solution
7. Estimation of amount of CH_3COOH pH metrically using NaOH solution
8. Determination of concentration of given KMnO4 solution Colorimetrically
9. Determination of concentration of given $K_2Cr_2O_7$ solution Colorimetrically
10. Distribution of acetic acid between n-butanol and water.
11. Distribution of benzoic acid between benzene and water
12. Preparation of urea – formaldehyde / phenol- formaldehyde resin.

Suggested Reading:

1. Vogel' S text book of quantitative chemical analysis by J. Mendham and Thomas,Person education Pvt.Ltd New Delhi ,6th ed. 2002
2. Laboratory Manual on Engineering Chemistry by Dr. Subdharani (Dhanpat Rai Publishing)
3. A Textbook on experiment and calculation in engineering chemistry by S.S. Dara S.Chand
4. Instrumental methods of Chemical Analysis, MERITT & WILLARD East-West Press).

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Choice Based Credit System (with effect from 2016-17)

B.E (Civil, EEE, Mech. and Prod.) and B.Tech (Chemical)

II - Semester						
S.No	**Code**	**Subject**	**L**	**T**	**P/D**	**Credits**
1	16MT C02	Engineering Mathematics - II	3*	-	0	3
2	16PY C01	Engineering Physics	3	-	0	3
3	16CY C02	Applied Chemistry	2	-	0	2
4	16EE C01	Elements of Electrical Engineering	3	-	0	3
5	16CE C01	Engineering Mechanics	3	-	0	3
6	16EG C01	Professional Communication in English	3	-	0	3
7	16CE C02	Environmental Studies	1	-	0	1
8	16ME C02	Engineering Graphics	1	-	3	3
9	16PY C03	Engineering Physics Laboratory	0	-	2	1
10	16CY C04	Applied Chemistry Laboratory	0	-	2	1
11	16EG C02	Professional Communication Laboratory	0	-	2	1
TOTAL			**19**	**--**	**09**	**24**

L - Lecture (clock hours) T - Tutorial (clock hours) P/D - Practical / Drawing (clock hours)

* One extra hour may be permitted in the timetable

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16 MT C02

ENGINEERING MATHEMATICS – II

Instruction	3L Periods per week + 1 (extra hour)
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To know the relevant methods to solve higher order differential equations.
2. To learn the Laplace and Inverse Laplace transforms for solving engineering problems.
3. To know improper integrals such as Beta, Gamma functions.
4. To learn Vector Differential Operator and its physical interpretations.
5. To evaluate vector line, surface & volume integrals.
6. Learn to apply all the above mathematical methods/techniques to interpret the results in physical and technical terms.

Course outcomes:

1. Solve the solutions of Differential Equations which arise in electrical circuits, vibrations and other linear systems.
2. Able to solve solutions of differential equations with initial and boundary value problems.
3. Evaluating definite integrals using Beta, Gamma functions.
4. Understating the significance of gradient, divergent and Curl.
5. Use Greens, Gauss and Stoke"s theorems to find the surface and volume integrals.
6. Able to solve and analyse the Engineering problems.

UNIT-I Ordinary differential Equations: Linear Differential equations of higher order with constant coefficients, complementary function and particular integrals when RHS is of the forms e^{ax} , $\sin ax$, $\cos ax$, x^m , $e^{ax}\,(v)$, $x^m\,(v)$,where v-is a function of x, Cauchy"s equation, electrical circuits of second order

UNIT-II Laplace Transforms: Laplace transforms of standard functions, Laplace transforms of piecewise continuous functions, first shifting theorem, multiplication by „t", division by „t". Laplace transforms of derivatives and integrals of functions-Unit step function-Periodic functions (without proofs). Inverse Laplace transforms-by partial fractions (Heaviside method), Convolution Theorem, Solving Ordinary differential equations by Laplace Transforms

UNIT-III Beta and Gamma Functions: Definitions of Beta and Gamma functions-elementary Properties of both Beta and Gamma functions, Relation between Beta and gamma functions, differentiation under the integral sign.

UNIT-IV Vector Differentiation: Scalar and vector fields- directional derivative- Gradient of a scalar-Divergence and Curl of a vector point function. Properties of divergence, curl, Solenoidal and Irrotational vectors

UNIT-V Vector Integration: Evaluation of Vector Line integrals, surface integrals and volume integrals, Greens, Gauss divergence and Stokes theorems (without proofs) and its applications

Text Books:

1. Erwin Kreyszig "Advanced Engineering Mathematics,"10th edition, John Wiley & Sons -Publishers.
2. R.K.Jain & S.R.K.Iyenger "Advanced Engineering Mathematics" , 3rd edition, Narosa Publications
3. Alen Jaffery "Mathematics for Engineers & Scientists" , 6th ed 2013 CRC press, Taylor & Francis Group. (Elsevier)
4. Dr.B.S.Grewal "Higher Engineering Mathematics", 43rd edition, Khanna Publishers.

Suggested Reading: (for further reading and examples on applications)

1. A.Craft and Robert Davison "Mathematics for Engineers-a modern interactive approach" -Willey
2. Loius Pipes "Applied Mathematics and physicists" Mc Graw Hill publishers.
3. Kanti.B.Datta "Mathematical Methods of Science & Engg," Aided with MATLAB,. Cengage Learning India Pvt.Ltd.
4. AR Collar and A. Simpson "Matrices for Engineering Dynamics" -John Willey & sons.

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16PY C01

ENGINEERING PHYSICS

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives: The objective of the course is to make the student
1. Understand the general concepts of physics
2. Acquire knowledge of different kinds of waves and their behavior
3. Familiar with crystal physics and materials
4. To introduce the general concepts of physics

Course Outcomes: At the end of the course, the student will be able to
1. Describe the types of oscillations and analyze them
2. Demonstrate the wave nature of the light
3. Develop the concepts related to electromagnetic behavior
4. Identify the various crystal systems and defects
5. Explain the origin of magnetism and dielectric polarization and applications of these materials in the field of engineering & technology

UNIT – I Waves and Oscillations: Review of free oscillations - Superposition of two mutually perpendicular linear SHMs of same frequency and 1:2 ratio frequency – Lissajous figures – Damped vibrations – Differential equation and its solution – Logarithmic decrement - Relaxation time – Quality factor – Forced vibrations – Differential equation and its solution – Amplitude resonance-Torsional pendulum.
Ultrasonics: Production of ultrasonics by piezoelectric and magnetostriction methods – Detection of ultrasonics – Determination of ultrasonic velocity in liquids – Applications.

UNIT – II Interference: Division of amplitude – Interference in thin films (reflected light) – Newton"s rings – & division of wavefront – Fresnel"s biprism.
Diffraction: Distinction between Fresnel and Fraunhoffer diffraction – Diffraction at single slit – Diffraction grating (N Slits) – Resolving power of grating.

UNIT – III Polarization: Malus"s law – Double refraction – Nicol"s prism – Quarter & Half wave plates – Optical activity – Laurent"s half shade polarimeter.
Electromagnetic Theory: Review of steady and varying fields – Conduction and displacement current – Maxwell"s equations in differential and integral forms – Electromagnetic wave propagation in free space, dielectric and conducting media – Poynting theorem.

UNIT – IV Crystallography: Space lattice - Crystal systems and Bravais lattices – Crystal planes and directions (Miller indices) – Interplanar spacing – Bragg"s law – Lattice constant of cubic crystals by powder diffraction method.
Crystal Imperfections: Classification of defects – Point defects – Concentration of Schottky and Frenkel defects – Line defects – Edge dislocation – Screw dislocation – Burger"s vector.

UNIT – V Magnetic Materials: Classification of magnetic materials – Langevin theory of paramagnetism – Weiss molecular field theory – Domain theory – Hysteresis curve – Structure of ferrites (spinel & Inverse spinel) – Soft and hard magnetic materials.
Dielectric Materials: Dielectric polarization – Types of dielectric polarization: electronic, ionic, orientation and space-charge polarization (Qualitative) – Frequency and temperature dependence of dielectric polarization – Determination of dielectric constant (Schering bridge method) – Ferroelectricity – Barium titanate – Applications of ferroelectrics.

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 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", McGahill Education Publications, 2013
3. P.K. Palanisamy, Engineering Physics", Scitech Publications, 2012
4. V. Raghavan, "Materials Science and Engineering", Prentice Hall India Learning Private Ltd., 6th Revised edition, 2015

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16CY C02

APPLIED CHEMISTRY

Instruction	2L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	20 Marks
Credits	2

Course Objectives:

Applied chemistry is a fascinating area with the profound implications for engineers as well as biologists. Materials fabricated and used in our daily life are derived from chemicals, both natural and synthetic and their range of utility are growing day by day. It is imperative that engineers of different disciplines acquire sufficient knowledge of the materials and their characteristics for making proper selection of their end -use application.

The various units of the syllabus is so designed to fulfill the following objectives.

1. To impart technological aspects of modern chemistry and to lay foundation for the application of chemistry in engineering and technology disciplines
2. The student should be conversant with the
   i. Principles of water characterization and treatment of water for potable and industrial purposes.
   ii. Principles of polymer chemistry and engineering applications of polymers in domestic and engineering areas
3. Knowledge to prevent corrosion of machinery and metallic materials and water chemistry which require serious attention in view of increasing pollution, has been included in the syllabus.
4. Study of polymers is insisted as it gives better insight to industrial personnel by being exposed to wider aspects of polymer science.
5. Study of fuel cells is given importance as fuel cells are the alternate energy sources for generating electrical energy on spot and portable applications.
6. Newer materials lead to discovering of technologies in strategic areas like defense and space research. Recently modern materials synthesized find applications in industry and technology and in order to emphasize them, topics like composite materials, polymers, conducting polymers and nano materials have been incorporated in the curriculum.
7. To enable students to apply the knowledge acquired in improving the properties of engineering materials.
8. To give an insight into nano materials and composite materials aspect of modern chemistry.

Course Outcomes:

1. At the end of the course, the students will be familiar with the fundamentals of water technology; corrosion and its control; applications of polymers in domestic and engineering areas; nano materials and their applications.
2. The engineer who has the above background can effectively manage the materials in his designing applications and for discovering & improving the systems for various uses in industry, agriculture, health care, technology, telecommunications and electronics.
3. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.
4. Study of nano related materials helps to update the knowledge necessary to launch into the demands of the world.

UNIT –I

Water Chemistry: Hardness of water – Types, units of hardness, Disadvantages of hard water - Boiler troubles - scales & sludge formation - causes and effects, softening of water by ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water, disinfection of water by chlorination, Ozonization, UV radiation.

UNIT -II

Corrosion Science : Introduction, chemical corrosion – oxidation corrosion , electro chemical corrosion and its mechanism , Galvanic corrosion and types of differential aeration corrosion (waterline corrosion) , Factors affecting corrosion (position of the metals in galvanic series, relative areas of anode and cathode, nature of corrosion product – solubility and volatility of corrosion product, nature of corroding environment – temperature, humidity and P^H. Corrosion control methods – cathodic protection, sacrificial anodic protection

UNIT – III

High Polymers: Definition of polymer, degree of polymerization. Thermo plastics and thermo sets. Preparation, properties and uses of plastics (Polyvinyl chloride, Bakelite), fibers (Kevlar, polyurethane), Rubbers – natural rubber and its chemical structure, vulcanization and its significance. Preparation, properties and uses of silicone rubber, conducting polymers – definition, classification and applications

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UNIT – IV

Battery Technology: Types of batteries - Primary batteries - Dry cell, Lithium battery; Secondary batteries - lead acid storage cell , Lithium ion battery ; Fuel cell - H_2-O_2 fuel cell, methanol-oxygen fuel cell – its advantages and applications

Solar cells – photo voltaic cells

UNIT–V

Engineering Materials: Nano materials – Introduction to nano materials and general applications, basic chemical methods of preparation – Sol-gel method. Carbon nanotubes and their applications

Composite materials – definition, types of composites, fibre reinforced, glass fibre reinforced and carbon fibre reinforced composites and applications.

Text Books:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Pub, Co., New Delhi (2002)
2. Applied Chemistry "A text for Engineering & Technology" Springer (2005).
3. ShasiChawla, "Text Book of Engineering Chemistry", Dhanpat Rai Publishing Company, NewDelhi (2008).
4. S.S. Dara "A text book of engineering chemistry" S.Chand & Co.Ltd., New Delhi (2006).
5. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
6. Applied Chemistry by N. Krishnamurthy:P. Vallinavagam. And K. Jeysubramanian TMH
7. Chemistry of Engineering Materials by CV Agarwal,C.P Murthy, A.Naidu, BS Publications.
8. Chemistry of Engineering Meterials by R.P Mani and K.N.Mishra, CENGAGE learning

Suggested Reading:

1. B.K.Sharma, "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001)
2. Water Treatment : F. I. Bilane, Mir publisher
3. Fundamentals of Corrosion: Michael Henthorne, Chemical Engineering.
4. A textbook of Polymer Science: Fred, Billmeyer Jr., Wiley India Third edition.
5. Chemistry of Advanced Materials: CNR Rao, Rsc Publication.
6. Materials Science and Engineering an Introduction, William D. Callister, (Jr. Wiley publisher).
7. Introduction to nano materials by T.Pradeep.

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16EE C01

ELEMENTS OF ELECTRICAL ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. To understand the basic concepts of electrical circuits.
2. To understand the principles of electromagnetic induction.
3. To know about different types of batteries, charging and discharging of batteries and types of fuel cells etc.
4. To know about different types of electrical wires and cables, domestic and industrial wiring.
5. To understand safety rules and methods of earthing.

Course Outcomes: After completion of the course, the student will be able to:
1. Acquire the knowledge of basic concepts of electrical circuits such as Ohm"s law, Kirchhorff"s laws etc.
2. Acquire the knowledge of basic Faraday"s laws of electromagnetic induction.
3. Acquire the knowledge to solve the problem of AC circuits.
4. Acquire the knowledge of specifications of batteries, types of cells and sources of renewable energy.
5. Acquire the knowledge of electrical wiring and cables and their types and electrical equipment and their specification.
6. Acquire the knowledge of safety precautions in handling electrical appliances, importance of grounding and methods of earthing.

UNIT-I DC Circuits
Current, voltage, power and energy, sources of electrical energy, independent and dependent sources, source conversion, circuit elements, Resistor, Inductor, Capacitor Ohm"s law, Kirchhoff"s laws, analysis of series, parallel and series-parallel circuits, star-delta conversion, Node and Mesh analysis (with independent sources only).

UNIT-II : Electromagnetism & AC Circuits Electric charge, electric field, lines of force, electric field intensity, electric flux and flux density, Faraday"s laws of electromagnetic induction, static and dynamically induced EMF.
A.C. Circuits: Generation of alternating voltage and current, equation of alternating voltage and current, average and rms values of sinusoidal quantities, form and peak factors, phasor representation of sinusoidal quantities, AC through pure resistance pure Inductance, pure capacitance, RL,RC,RLC circuits.

UNIT-III: Batteries and Fuel Cell
Introduction to batteries, simple cell, EMF and internal resistance of a cell, primary and secondary cells, cell capacity, types and specifications of batteries, charging and discharging of battery, safe disposal of batteries; fuel cell, principle and types of fuel cell, different sources of renewable energy.

UNIT-IV: Electrical Wiring
Types of wires and cables, types of connectors and switches, system of wiring, domestic and industrial wiring, simple control circuit in domestic installation, electrical equipment and their specifications

UNIT-V: **Safety & Protection**
Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, other electrics hazards, safety rules, importance of grounding and earthing of electrical equipment, methods of earthing, circuit protection devices: Fuses, MCB, ELCB and Relays.

Text Books:

1. Edward Hughes, "Electrical and Electronics Technology", 10th Edition, Peasson Publishers 2010.
2. V.K. Mehta & Rohit Mehta, "Principles of Electrical Engineering", S.Chand Company Limited 2008
3. B.L. Theraja & A.K. Theraja, "Electrical Technology", Vol.I, S.Chand Company Limited 2008.

Suggested Reading:

1. P.V.Prasad & S. Siva Nagraju, "Electrical Engineering: Concepts & Applications", Cengage Learning, 2012.
2. S. Rao, "Electrical Safety, fire safety engineering & Safety Management", Khanna publications, 1998.
3. Surjit singh & Ravi Deep Singh, "Electrical Estimating and Costing", Dhanapath Rai & Co., 1997.

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16CE C01

ENGINEERING MECHANICS

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives: During this course, students should develop the ability to:

1. Work comfortably with basic engineering mechanics concepts required for analyzing static structures
2. Identify an appropriate structural system to study a given problem and isolate it from its environment.
3. Analyze and model the problem using free-body diagrams and equilibrium equations
4. Apply pertinent principles to the system to solve and analyze the problems subjected to frictional forces.
5. Understand the meaning of centroid/ centers of gravity and moments of Inertia using integration methods.
6. Communicate the solution to all problems in an organized and coherent manner and elucidate the meaning of the solution in the context of the problem.

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

1. Solve problems dealing with forces in planar force systems
2. Draw free body diagrams to analyze the forces in the given structure
3. Understand the concept of moments and couples in plane systems.
4. Understand the mechanism of friction and can solve friction problems
5. Determine the centroid of plane areas and centers of gravity of bodies using integration methods
6. Determine moments of inertia, product of inertia for all areas and mass moments of inertia for bodies,

UNIT – I

Force Systems: Resolution of coplanar and non-coplanar force systems (both concurrent and non-concurrent), Determining the resultant of planar force systems. Moment of force and its applications and couples

UNIT – II

Equilibrium of force system: Free body diagrams, equations of equilibrium of planar force systems and its applications. Problems on general case of force systems

UNIT – III

Theory of friction: Introduction, types of friction, laws of friction, application of friction to a single body & connecting systems. Wedge and belt friction

UNIT– IV

Centroid: Significance of centroid, moment of area, centroid of line elements, plane areas, composite areas, theorems of Pappus & its applications. Center of gravity for elementary and composite bodies

UNIT – V

Moment of Inertia: Definition of MI, Polar Moment of Inertia, radius of gyration, transfer theorem, moment of Inertia of elementary & composite areas, product of inertia. Mass moments of inertia for elementary and composite bodies

Text Books:

1. K. Vijay Kumar Reddy and J. Suresh Kumar, Singer"s Engineering Mechanics, BS Publications, Hyderabad, 2011.
2. Ferdinand L Singer, Engineering Mechanics, Harper and Collins, Singapore, 1904.

Suggested Reading:

1. A. Nelson, Engineering Mechanics, Tata McGraw Hill, New Delhi, 2010.
2. S. Rajashekaran & G. Sankarasubramanyam, Engineering Mechanics, Vikas publications, Hyderabad, 2002.
3. S.B. Junarkar and H.J Shah, Applied Mechanics, Charotar publishers, New Delhi, 2001.
4. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press, New Delhi, 2008.
5. A K Tayal, Engineering Mechanics, Umesh Publications, New Delhi, 2010

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16EG C01

PROFESSIONAL COMMUNICATION IN ENGLISH

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To enable the students to understand the role and importance of communication and to develop their basic communication skills in English.
2. To strengthen the students‟ usage of grammar and to develop their vocabulary.
3. To improve the students‟ listening skills and introduce them to different reading strategies.
4. To equip the students with appropriate writing skills.
5. To enhance imaginative and critical thinking through literary texts and book review.

Course Outcomes: The students will

1. Understand the nature, process and types of communication and will communicate effectively without barriers.
2. Understand the nuances of listening and will learn to make notes
3. Read different texts, comprehend and draw inferences and conclusions.
4. Write effective paragraphs, letters and reports
5. Critically analyze texts and write book reviews

UNIT- I Understanding Communication in English: Introduction, nature and importance of communication. Process of communication. Basic types of communication - verbal and non verbal. One way vs. Two way communication. Barriers to communication. Intrapersonal and interpersonal communication. Johari Window.
Grammar & Vocabulary: Parts of speech, figures of speech – Euphemism, Hyperbole, Irony, Metaphor, Onomatopoeia, Oxymoron, Paradox, Personification, Pun & Simile

UNIT- II Developing Listening Skills: Exposure to recorded and structured talks, class room lectures- problems in comprehension and retention. Types of listening, barriers to listening, effective listening strategies. Note –taking.
Grammar & Vocabulary: Articles, Prepositions, Phrasal verbs, Idioms.

UNIT- III Developing Writing Skills: Sentence structure. Brevity and clarity in writing. Cohesion and coherence. Paragraph writing. Letter writing - form and structure, style and tone. Kinds of Letters –Apology and request letters. Email etiquette. Report writing.
Grammar & Vocabulary: Tense, Conditionals, homonyms, homophones.

UNIT - IV Developing Reading Skills: The reading process, purpose, different kinds of texts. Reading comprehension. Techniques of comprehension – skimming, scanning, drawing inferences and conclusions. Note-making
Grammar &Vocabulary: Concord, Connectives, Active and Passive voice, Words often confused.

UNIT- V: Reading for Enrichment

1.	The Road Not Taken	Robert Frost
2.	Goodbye Party For Miss Pushpa T. S	Nissim Ezekiel
3.	The Open Window	Saki
4.	The Romance Of A Busy Broker	O. Henry

Book reviews -Oral and written review of a chosen / novel/ play - a brief written analysis including summary and appreciation. Oral presentation of the novel/play
Grammar & Vocabulary: Indianisms, Common errors, Parallelisms.

Text Books:

1. Vibrant English, Orient Blackswan Ltd,

Suggested Reading:

1. M .Ashraf Rizvi, Effective Technical Communication, Tata Mc Graw- Hill, New Delhi
2. Meenakshi Raman and Sangeetha Sharma, Technical Communication - Principles and Practice, Oxford Univ. Press, New Delhi.
3. Sunil Solomon, English for Success, Oxford University Press, 2015
4. Krishna Mohan, Meera Banerji, Developing Communication Skills, McMillan India Ltd.
5. Michael McCarthy, English Vocabulary in Use.
6. Brikram K Das, Kalyani Samantray, An Introduction to Professional English and Soft Skills Cambridge Univ. Press, New Delhi.

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16CE C02

ENVIRONMENTAL STUDIES

Instruction	1L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	- - -
Credits	1

Course Objectives:
1. To equip the students with inputs on the environment, natural resources and their conservation.
2. To study the interrelationship between the living organisms and the natural environment and also to enable the students to understand the structure and functioning of the ecosystems.
3. To understand the importance of biodiversity and create awareness on its threats and conservation strategies.
4. To enable the students become aware of pollution of various environmental segments including their causes, effects and control measures.
5. To create awareness about environmental legislations in the context of national conventions.

Course Outcomes: At the end of the course, the student should have learnt
1. To understand the scope and importance of environmental studies, identify the natural resources and ecosystems and contribute for their conservation.
2. To understand the ecological services of biodiversity and contribute for their conservation.
3. To develop skills to solve the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
4. To relate the social issues and the environment and contribute for the sustainable development.
5. To understand the essence of the ethical values of the environment for conserving depletable resources and pollution control.

UNIT – I
Environmental Studies: Definition, Scope and importance, need for public awareness.
Natural resources: Water resources- hydrological cycle, use and over utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Food resources- Changes caused by modern agriculture, fertilizers-pesticide problems, water logging and salinity. Forest resources- use and over exploitation, deforestation. Mineral resources- Use and exploitation, effects of mining. Energy resources- Growing energy needs, various renewable and non-renewable energy sources. Land resources- land as a resource, land degradation- causes and effects, Role of individuals in conservation of natural resources.

UNIT – II
Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, concept of food chains, food webs, ecological pyramids.

UNIT – III
Biodiversity: Types/classification of biodiversity, India as a mega diversity nation, values of biodiversity, threats to biodiversity, Conservation of biodiversity.

UNIT – IV
Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, Soil pollution, Noise pollution and Thermal pollution.
Environmental Legislations: Environment protection act, Air, Water, Forest & Wild life acts.

UNIT – V
Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development, Population explosion and Climate change: Global warming, Acid rain, Ozone layer depletion.

Text Books:
1. P. D.Sharma, "Ecology & Environment", Ashish publications, 1994
2. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004

Suggested Reading:
1. Dr. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria & Sons, 2009
2. C. S. Rao, "Environmental Pollution Control Engineering", Wiley, 1991
3. S. S. Dara, "A Text Book of Enviromental Chemistry & Polution Control", S. Chand Limited, 2006

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16ME C02

ENGINEERING GRAPHICS

Instruction	1L + 3D Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. To provide an exposure in understanding the drawings during a multidisciplinary approach towards a problem
2. To train up in perception and imagination of a three dimensional scenario.

Course Outcomes:
1. To understand theory of projections
2. Ability to improve visualization skills
3. Ability to sketch Engineering Objects

UNIT – I
Introduction to Engineering Drawing: Drawing Instruments and their uses, types of lines, use of pencils, Lettering, Rules of dimensioning
Conic Sections: Ellipse, Parabola, Hyperbola including the Rectangular Hyperbola (General method only)
Cycloidal curves: Construction of cycloid, epi-cycloid, hypo-cycloid & involutes

UNIT – II
Orthographic Projections: Principles of Orthographic Projections – Conventions , Projection of Points, Projection of Lines - inclined to both planes.

UNIT – III
Projections of Planes: Projections of regular Planes – Perpendicular planes and Oblique planes.

UNIT – IV
Projections of Solids: Projections of Regular Solids – Regular Polyhedra, solids of revolution, (Simple position only)
Sections of Solids: Types of cutting planes – their representation – sections of solids in simple position.

UNIT – V
Introduction to Graphic packages: Getting started, Basic drawing and editing commands, creating lines, planes and solids.

Note: Syllabus for external examination will be from unit 1 to unit 4 only & unit-5 is exempted from external examination. Unit 5 is for internal examination only.

Text Books:

1. N.D.Bhatt," Elementary Engineering Drawing", Charotar Publishers, 2012
2. Basanth Agrawal and C M Agrawal "Engineering Drawing 2e ", McGraw-Hill Education(India) Pvt. Ltd.

Suggested Reading:

1. K.L.Narayana and P.K.Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011
2. P.S.Gill" "Engineering Graphics", Kataria Publications, 2011
3. K.Veenugopal, "Engineering Drawing and Graphics + Autocad", New Age International Pvt. Ltd, 2011
4. Shaw M.B and Rana B.C., "Engineering drawing", Pearson, 2nd edition, 2009
5. P I Varghees, " Engineering Graphics ",Tata McGraw-Hill publications, 2013
6. Bhattacharya. B, "Engineering Graphics", I. K. International Pvt. Ltd, 2009
7. Dhawan R.K., "Principles of Engineering Graphics and Drawing", S. Chand, 2011

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16PY C03

ENGINEERING PHYSICS LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives: The objectives of the course is to make the student
1. Apply theoretical physics knowledge in doing experiments
2. Understand the behavior of the light experimentally
3. Analyze the behavior of magnetic and dielectric materials

Course Outcomes: At the end of the course, the student will be able to
1. Understand the concept of errors and find the ways to minimize the errors
2. Demonstrate interference and diffraction phenomena experimentally
3. Distinguish between polarized and unpolarized light
4. Determine the loss of energy of a ferromagnetic material and its uses in electrical engineering
5. Understand the suitability of dielectric materials in engineering applications

List of 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 mercury light
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. B-H Curve – Determination of hysteresis loss of given specimen
9. Dielectric Constant – Determination of dielectric constant of given PZT sample
10. Ultrasonic Interferometer – Determination of velocity of ultrasonics in given liquid

Note: A student must perform a minimum of eight experiments.

Suggested Reading:

1. "Engineering Physics" - Manual by Department of Physics, CBIT, 2016
2. S.K. Gupta, "Engineering Physics Practical", Krishna"s Educational Publishers, 2014
3. O.P. Singh, V. Kumar and R.P. Singh, "Engineering Physics Practical Manual", Ram Prasad & Sons Publications, 2009

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16CY C04

APPLIED CHEMISTRY LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives:

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory
2. For practical understanding of theoretical concept of chemistry.
3. The student should be conversant with the principles water characterization and treatment of potable and industrial purposes.

Course Outcomes:

1. This syllabus helps the student to understand importance of analytical instrumentation for different chemical analysis.
2. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.

LIST OF EXPERIMENTS

1. Introduction to chemical analysis
2. Preparation of standard solution of oxalic acid and Standardization of NaOH
3. Estimation of amount of oxalic acid in the given solution using Mohr‟s salt and $KMnO_4$
4. Estimation of total hardness of water using EDTA solution
5. Estimation of temporary hardness and permanent hardness of water using EDTA solution
6. Estimation of amount of carbonate in the given solution using HCl link solution
7. Estimation of amount of carbonate and bicarbonate in the given solution using HCl link solution
8. Estimation of amount of HCl conductometerically using NaOH solution
9. Estimation of amount of CH_3COOH conductometerically using NaOH solution
10. Estimation of amount of HCl and CH_3COOH present in the mixture of acids conductometerically using NaOH solution
11. Estimation of amount of HCl potentiometrically using NaOH solution
12. Estimation of amount of Fe^{+2} potentiometrically using $KMnO_4$ solution

Suggested Reading:

1. Applied Chemistry: Theory and Practice (Latest ed.), By O.P. Vermani & A.K. Narula
2. Vogel‟s Textbook of Quantitative Chemical Analysis (Latest ed.), Revised by G.H. Jeffery, J. Bassett, J. Mendham & R.C. Denney
3. Instrumental methods of Chemical Analysis, MERITT & WILLARD East-West Press

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16EG C02

PROFESSIONAL COMMUNICATION LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives:

1. To introduce students to phonetics and the different sounds in English.
2. To familiarize the students with the software and give them sufficient practice in correct pronunciation.
3. To enable students to speak English correctly with focus on stress and intonation.
4. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be onfluency rather than accuracy.
5. To understand team work, role behavior and to develop the ability to analyze, evaluate, construct and refute arguments.

Course Outcomes:

1. The students will understand the speech sounds in English and the nuances of pronunciation.
2. The students will understand tone, intonation and rhythm and apply stress correctly.
3. The students will be able to participate in group discussions with clarity and confidence.
4. The students will speak confidently on stage with appropriate body language.
5. The students will debate on various issues and learn to work in teams.

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, consonantclusters.
3. **Aspects of connected speech**: Strong forms, weak forms, contracted forms, elision.
4. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
5. **Rhythm & Intonation**: Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
6. **Listening skills** – practice with IELTS and TOEFL material
7. **Situational dialogues and role play**
8. **Public speaking** is to be shown by incorporating narrative examples and extracts from speeches.
9. **Group Discussions**– videos to be shown and practice sessions
10. **Poster making** – preparation and presentation
11. **Debate** - Differences between a debate and a group discussion. Essentials of a debate, conducting a debate.

Suggested Reading:

1. E Suresh kumar et al, . English for Success (with CD), Cambridge University Press India Pvt Ltd. 2010.
2. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016
3. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
4. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
5. Edgar Thorpe. Winning at Interviews, Pearson Education, 2006
6. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd 2011

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Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives

1. *To understand Inductance and capacitance calculations for different line configurations*
2. *To understand per unit system representation in power systems.*
3. *To understand the importance of transmission line representation in terms of short, medium and long lines in finding performance of lines*
4. *To understand the importance of symmetrical and un-symmetrical faults in power systems.*
5. *To study the causes of over voltages and bewley lattice diagram.*

Course Outcomes: The student will be able to

1. *Acquire knowledge in calculation of inductance and capacitance of lines*
2. *Acquire knowledge to represent the power system data in per unit and consider appropriate line models to find the performance of transmission lines*
3. *Acquire the concepts of corona and effect of corona in power system.*
4. *Acquire knowledge to study different types of faults, and its relevance in relay settings.*
5. *Acquire knowledge in finding the transmission line wave equation and able to find various*

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coefficients of lines and draw the Bewley Lattice diagram.

UNIT-I

Line Parameter Calculations: Calculating Inductance & Capacitance of Transmission Lines, single phase and three phase symmetrical composite conductors, GMD, GMR, Transposition of conductors, Bundled conductors, effect of earth capacitance.

UNIT-II

Modeling of Transmission Lines: Short, medium, long lines, Line calculations, Tuned Lines, Surge impedance loading.

Corona: Causes, Disruptive and Visual Critical Voltages, Power loss, minimization of Corona effects.

UNIT-III

Per Unit System of Representation: Use of per unit quantities in power systems, Advantages of per unit system.

Symmetrical Faults: Short Circuit Currents, Reactance of Synchronous Machines, fault Calculations, Short circuit capacity of a bus.

UNIT-IV

Unsymmetrical Faults: Symmetrical components of unsymmetrical Phasors, Power in terms of symmetrical components, 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-V

Transients in Power Systems: Causes of over voltages. Travelling Wave Theory, Wave equation, Reflection and refraction Coefficients, Junction of Cable and overhead lines, Junction of three lines of different natural impedances, Bewley Lattice diagram.

Text Books

1. C.L. Wadhwa, Electrical Power Systems, Wiley Eastern Ltd., 4dtEdition, 2006
2. I.J. Nagrath & D.P.Kothari Modern Power Systems Analysis, TMH Edition, 2003.

Suggested Reading

1. John J. Grainger William D.Stevenson Jr. Power System Analysis, Tata McGraw Hill Edn. 2003
2.A.Chakrabarti, M.L.Soni, P. V.Gupta, U.S.Bhatnagar, A Text book on Power System, Dhanpat Rai & Co (P)Ltd -1999.

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EE 312 **ELECTRICAL MACHINERY-II**

Instruction	4L+1T Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:
1. To study the principles of tap changing, tests and auto-transformer.
2. To understand different types of three phase induction motors.
3. To discuss about speed control and starting methods of three phase induction motors.
4. To analyze unbalanced operation of three phase induction motors and three phase transformers .
5. To familiarize the construction details, principle of operation, prediction of performance of single phase induction motors.

Course Outcomes: The student will be able to:
1. Apply basic principles of tap changing and auto-transformer.
2. Acquire knowledge about operation and performance analysis of three phase induction moto rs.
3. Obtain the concepts of speed control and starting methods of three phase induction motors .
4. Analyze unbalanced operation of three phase induction motors and three phase transformers.
5. Acquire the concept of single phase induction motors.

UNIT-I

Transformers: Cooling arrangement in Transformers. Testing of Transformers, Routine Tests and Special tests, Measurement of Voltage ratio and check for voltage vector relationship. Measurement of Insulation resistance. Maintenance of Transformers. Tap changer on transformers, No-load tap changer, On-load tap changer. Third harmonic voltages and tertiary winding in three phase transformers, Auto Transformer, Comparison with two winding transformers, Conversion of two winding transformer to auto transformer.

UNIT-II

Three-phase Induction Motor: Constructional features, Rotating Magnetic field theory, Principle of operation of squirrel cage and slip ring motors, Vector Diagram, Equivalent circuit, Expression for torque, Starting torque, Maximum torque, Slip/Torque characteristics, Performance characteristics, Equivalent circuits from test, Current loci circle diagram, Predetermination of characteristics of Induction Motors.

UNIT-III

Starting methods of Induction motors: Modes of operation, torque and power limits of Induction motors, Speed control methods, Resistance Control, Voltage control, pole changing, Cascading, variable frequency control , Slip power recovery schemes Kramer drive. Scherbius drive, Double cage Induction motors, Induction generator, Doubly fed Induction Generator.

UNIT-IV

Unbalanced Operation : Voltage Unbalance, Unbalanced Operation of 3-phase Induction Motor, Per Phase Equivalent Circuits, Single Phasing, Unbalanced Operation of 3-Phase Transformers, Single-phase load on Three-phase transformers Single Phasing in 3-phase transformers- Delta /Star and Star/Delta transformers.

UNIT-V

Single Phase motors: Single phase motors, Theory and operation of single phase motors, Shaded pole, Split phase and capacitor motors, Compensated and uncompensated series and repulsion motors. Linear Induction motors .

Text Books:

1. P.S. Bhimbra Electrical machinery, Khanna Publications, 7th edition, 2003.
2. Nagrath I.J & Kothari D.P, Electrical Machines, Tata McGraw Hill Publications, Sigma serie s, 2006.
3. H.Cotton, Advanced Electrical Technology, Wheeler & Co,7th edition, CBS publishers,2005.
4. Theory and performance of electrical machines by J.B Gupta ,S.K. Kataria & Sons,14th edition,2014.

Suggested Reading:

1. Juha Pyrho¨ nen, Tapani Jokinen and Valeria Hrabovcova, Design of rotating electricalmachines, John Wiley & Sons, Ltd. 2008.
2. Fitzgerald, Kingsley, Umans, Electric Machinery, Tata Mc-Graw Hill Publications, 6th edition, 2002.
3. Electrical machines by Ashfaq husain, Danpatrai and sons, 3nd edition, 2012

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EE 313 LINEAR CONTROL SYSTEMS

Instruction	4L + 1T Periods per week
Duration of Semester Examination	3Hours
Semester Examination	75Marks
Sessional	25Marks
Credits	3

Course Objectives:
1. To understand different types of linear control systems and their mathematical modeling.
2. To study the transfer functions of control system components
3. To study Stability analysis, both in time and frequency domains
4. To study the concepts of State space representation of Linear Time invariant systems (LTI)

Course Outcomes: The student will be able to:
1. Build different mathematical models for any LTI physical /electrical systems
2. Derive the transfer function of components used in feedback control systems
3. Apply the concepts of stability analysis in time and frequency domains, which is essential to analyze any system performance.
4. Apply the concepts of state space controls
5. Design conventional controllers and compensators used for closed loop performance.

UNIT I

Introduction: Concepts of control systems- Open loop and closed loop control systems and their differences, Different examples of control systems, Classification of control systems, Feedback Characteristics, Effects of feedback. Mathematical models, Differential equations, Impulse Response and transfer functions, Translational and Rotational mechanical systems, Analogous systems.

UNIT -II

Transfer Function Representation: Two Phase Serve motor characteristics, Transfer Function of DC and AC Servo motor, Potentiometers, Synchro transmitter and Receiver, Tacho generator, Stepper Motor characteristics, Block diagram algebra, signal flow graphs and problems.

UNIT -III

Time Response Analysis: Standard test signals, Time response of first/second order systems, Transient response of second order system for step input. Time domain specifications, Types of systems, static error coefficients, Routh-Hurwitz criterion of stability, Root locus technique , Typical systems analyzed by root locus technique, Effect of location of roots on system response, PID Controllers.

UNIT IV

Frequency Response Analysis: Introduction, Frequency domain specifications for a second orde r system, Bode plots, Stability Analysis from Bode plots. Polar plots, Nyquist criterion for stability. Compensation techniques, Lag, Lead, Lead-Lag Controllers design in frequency domain.

UNIT V

State Space Representation: Concept of state, state variable, state models of linear time invariant systems, Derivation for state models from transfer functions and differential equations, State transition matrix-solution of state equations by time domain method. Obsevability and Controllability, Introduction to discrete control systems.

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.

Suggested Reading:

1. M.Gopal, Control Systems Principles and Design- Tata McGraw Hill, 2nd Edition, 2003.
2. N.C Jagan-control Syste ms, 2nd Edition, BS Publications, 2008
3. N. Nise, Control Systems Engineering, 6th edition, Willey Publications, 2011.
4. Linear Control System analysis and design with MATLAB, Taylor & Francis D'Azzo- Control Systems, 2009

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EE 314 *POW ER ELECTRONICS*

Instruction	4L+1T Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objective: The objective of the course is to

1. Introduce the characteristics of various power semiconductor switches and their applications.

2. Make acquainted with the operating principles of AC-DC, DC-DC, AC-AC and DC-AC converters, methods of voltage control and converters applications.

Course Outcomes: The student will be able to:

1. *Gain knowledge of basic operation of various power semiconductor devices and to compare their characteristics.*
2. *Design protection circuit and control circuits for SCR.*
3. *Acquaint with the principles of phase controlled converters.*
4. *Analyze the operation principles of different DC-DC, AC-AC converters.*
5. *Identify different topologies of DC-AC converters.*

UNIT-I

Power Diodes and Transistors: Power diode, characteristics, Recovery characteristics, Types of power diodes, General purpose diodes, Fast recovery diodes, their applications. Bipolar Junction Transistors(BJT), Power MOSFETs, IGBTs-Basic structure and working, Steady state and switching characteristics, 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

Principles of phase controlled converters: 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, Introduction to Buck, Boost and Buck-Boost regulators.

AC-AC Converters:

Principle of operation of Single phase Cyclo-converters and their applications. Single -phase AC Voltage Controllers with R and RL loads.

UNIT-V

Inverters: Principle of operation of Single -phase Inverters, Voltage control methods, Single pulse width modulation, Multiple pulse width modulation, Sinusoidal pulse width modulation, Comparison of Voltage Source Inverters and Current Source Inverters, Three -phase bridge Inverters, 180^0 & 120^0 modes of operation.

Text Books:

1. Singh.M.D and Khanchandani.K.B,Power Electronics, Tata McGraw Hill, 2nd Edition, 2006.
2. Rashid.M.H. Power Electronics Circuits Devices and Applications. Prentice Hall of India, 2003
3. Bimbra.P.S, Power Electronics, Third Edition, Khanna Publishers, 2013

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Suggested Reading:

1. Mohan, Undeland , Robbins, Power Electronics, John Wiley, 1996.
2. P.C.Sen, Power Electronics, Tata Mc-Graw Hill, 1st Edition, 2001.

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With effect from the academic year 2015-2016

EE 315 *LINEAR INTEGRATED CIRCUITS*

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To study the characteristics of operational amplifiers, stability, basic applications such as integrator, differentiator etc.,
2. To study the different applications of operational amplifiers in voltage limiter, Schmitt trigger, instrumentation circuits.
3. To study the concepts of waveform generation, sine, square, triangular using op-amps.
4. To study the operation of 555 timer as a monostable and an astable multivibrator.
5. To study different types of voltage regulator, Filters and their characteristics.

Course Outcomes: The student will be able to:

1. Understand the basic characteristics of op-amps and their significance.
2. Analyze a typical op-amp equivalent circuit by calculating its voltage gain and input resistance.
3. Define stability for a amplifier circuit.
4. Analyze an instrumentation amplifier circuit and discuss its applications.
5. Analyze higher order filter circuits and explain their significance.
6. Analyze and design voltage regulators (Fixed voltage and adjustable voltage).

UNIT-I

Operational Amplifiers Characteristics: open loop voltage gain, output impedance, input impedance, common mode rejection ratio, Offset balancing techniques, Slew rate, Frequency response, Stability, frequency compensation of Op-amp.

Basic OP-Amp Applications: inverter summer, analog integrator, differentiator, current to voltage converter, voltage to current converter, voltage follower, ac amplifier.

UNIT-II

OP-Amp Applications: Voltage limiter, clipper & clamper, precision rectifier, full wave and half wave, peak detector, comparator, zero crossing detector, Schmitt trigger, monostable, astable, bistable multiplier, divider, difference amplifier instrumentation amplifier circuits using Op-amps.

UNIT-III

W aveform Generation using Op-Amps: Sine, Square, Triangular and Quadrature oscillators, voltage controlled oscillator / multi vibrator, voltage to frequency converter, 555 timer functional diagram, operation as monostable and astable. phase locked loop, A/D and D/ A converters.

UNIT-IV

Voltage Regulators: Series voltage regulator using Op-amp, shunt regulators using Op-amp, switching regulators using Op-amp, dual voltage regulator, fixed voltage regulators, dual tracking regulators, hybrid regulator, current sensing and current feedback protection.

UNIT-V

Filters: RC active filters, low pass, high band pass, band reject, notch, first order, second order transformation, state variable filter, switched capacitor filter, universal filte r, Balanced modulator/ demodulator.

Text Books:

1. D.Roy Choudhury, Linear Integrated Circuits, Shail B.Jain, 3rd Edition, New Age International(P) Ltd., 2007.
2. Malvino Albert Paul, Electronic Principles, 7th Edition, Tata McGraw Hill, 2006
3. Coughlin and Driscoll, Operational Amplifiers and Linear integrated Circuits, 6th Edition, Prentice hall of India 2003.

Suggested Reading:

1. Gayakwad R.A. Op-Amps and Linear Integrated Circuits, 4th Edition, Prentice Hall of India, 2002.
2. David A. Bell, Operational Amplifiers and Linear IC s, PHI, 2003.

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CE 444 HUMAN VALUES AND PROFESSIONAL ETHICS

Instructions	: 21 Periods per semester (7*3)
Duration of University Examination	: 2 Hours
University Examination	: 50 Marks
Sessional	: Nil
Credits	: Nil

Course Objectives:

1. To develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. To enable the students understand the values, the need for value adoption and prepare them meet the challenges
3. To enable the students develop the potential to adopt values, develop a good character and personality and lead a happy life
4. To motivate the students practice the values in life and contribute for the society around them and for the development of the institutions /organisation around they are in.
5. To make the students understand the professional ethics and their applications to engineering profession

Course Outcomes

1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, convert everything into happiness and contribute for the happiness of others.
4. Students become potential sources for contributing to the development of the society around them and institutions / organisations they work in.
5. Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

UNIT-1 Concepts and Classification of Values -Need and challenges for value Adoption

Definition of Values – Concept of Values – Classification of Values – Hierarchy of Values – Types of Values –Espoused and Applied Values – Value judgement based on Culture – Value judgement based on Tradition – Interdependence of Values

Need for value education – Findings of Commissions and Committees - Corruption and illegal practices – Science and Technology without values- Exploitation of nature – Increasing use of violence and intoxicants – Lack of education in values – Implications of education in values – Vision for a better India

Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges

UNIT - 2: Personal Development and Values in Life

Personal Development: Enlightened self-interest – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity – The quest for Character – Tests of Character – The key to good character

Values in Life: Building an ethical policy – Integrating values in everyday life – Archaic Social Values – Parenting practices – Critical Thinking - Analyzing and Prioritizing values – Practicing Yoga and Meditation

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UNIT - 3: Practicing Values for the development of Society

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Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atrocities – Environmental awareness – Working for the Sustainable development of the society

Values in Education system: Present Scenario- Engineering education –Current trends- Need for quality improvement- Adoption of value education – Principles of Integrity-Institutional Development.

UNIT - 4: Basic Concepts of Professional Ethics

Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional ethics, Ethical dilemmas, Indian and Global thoughts on ethics, Profession, Profe ssional and Professionalism, Ethical role ofa professional Basic ethical principles, Some basic ethical theories, use of ethical theories.

Science, Religion Ethics, Genders and ethics, Media and ethics, Computer Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities

UNIT-5: Ethics in engineering profession

Engineering profession-Technology and Society-Engineering as Social Experimentation-Engineering ethics-Ethical obligations of Engineering Professionals-Role of Engineers-Engineers as Managers-Professional responsibilities of Engineers- Engineers Responsibility for Safety- A few Case Studies on Risk management

Conflicts of Interest- Occupational Crimes- Plagiarism-Self plagiarism-Ethics Audit-Consideration for ethics audit-Ethics Standards and Bench Marking

Text Books:

1. Subramanian R., “ Professional Ethics “ , Oxford University Press , 2013
2. Nagarajan R.S., “ A Text Book on Human Values and Professional Ethics “ New Age Publications , 2007
3. Dinesh Babu S., “ Professional Ethics and Human Values “ , Laxmi Publications , 2007

Reference Books:

4. SantoshAjmera and Nanda Kishore Reddy “ Ethics , Integrity and Aptitude “ ,McGrawhill Education Private Limited , 2014
5. GovindaRajan M., Natarajan S., Senthil Kumar V.S.” Professional Ethics and Human Values “ Prentice Hall India Private Limited ,2012
6. Course Material for Post Graduate Diploma In “Value Education & Spirituality “ Prepared by Annamalai University in Collaboration with Brahma Kumaris , 2010

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EE 316 *ELECTRICAL MACHINES -I LAB*

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. To understand the performance & Load characteristics of different types of DC generators & Motors.
2. To understand the procedure to separate core losses in a single phase transformer, perform OC and SC test on transformer and conduct Sumpner's test on two identical transformers.
3. To understand the procedure to estimate the efficiency of DC machine by Hopkinson test.
4. To understand the control procedure and vary speed of DC shunt motor.
5. To understand the process of dynamic braking.

Course Outcomes: The student will be able to:

1. Acquire requisite knowledge to evaluate and compare the characteristics and performance aspects of different types DC generators and motors by conducting suitable tests.
2. Acquire knowledge to analyze the single phase transformer by performing the suitable tests.
3. Gain practical knowledge to know different losses and efficiency in DC machine and their dependence on other parameters such as speed, field current etc., and also calculate efficiency at different loads.
4. Gain knowledge to perform speed control of DC shunt motor
5. Calculate moment of inertia of DC machine through retardation curve.

List of Experiments:

1. Magnetization characteristics and the speed verses voltage curve of separately and self exci ted D.C. generator
2. Load characteristics of separately excited and self excited Shunt Generators
3. Load characteristics of DC Compound ge nerator
4. Performance characteristics of Series Motor
5. Swinburne's Test & Performance characteristics of D.C. shunt motor.
6. Performance characteristics of DC Compound motor
7. Separation of iron and friction losses and estimation of parameters in D.C. machines.
8. Speed control of D.C. shunt motor by shunt field control and armature resistance control
9. Separation of core losses in a Single Phase transformer
10. Open circuit and short circuit tests on a Single Phase transformer
11. Sumpner's test on two identical transformers
12. Estimation of efficiency of DC Machine by Hopkinson test.
13. Retardation Test, Dynamic Braking of DC Shunt Motors.

Note: ATLEAST 10 EXPERIMENTS SHOULD BE CONDUCTED IN THE SEMESTER

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EE 317 *CONTROL SYSTEMS LAB*

Instruction	3 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	50Marks
Sessional	25Marks
Credits	2

Course Objectives:

1. To understand the characteristics of DC, AC Servo Motors and synchro pair.
2. To understand the frequency response of compensating networks.
3. To study the closed loop performance for given plant using
   i) P, PI and PID controllers ii) ON/OFF controller.

Course Outcomes: The student will be able to

1. Obtain DC, AC Servo Motors and Synchro pair characteristics.
2. Design, Analyze and Simulate performance of a given second order plant from frequency and time response point of view.
3. Gain knowledge in visualizing the designing, functioning and simulation of compensators in improving the stability of the system.
4. Determine the time and frequency domain specifications of second order system
5. Acquire knowledge in analyzing the performance of P, PI, PID and ON/OFF controller and to distinguish the merits and de-merits of different types of controllers in closed loop environment.

List of Experiments:PART

A

Any Eight of the following experiments are to be conducted

1. Characteristics of D.C Servo motor.
2. Characteristics of A.C. Servo motor.
3. Characteristics of Synchro Pair.
4. Step response of second order system.
5. Frequency response of compensating networks.
6. Closed loop P, PI and PID Controller for temperature of a given plant.
7. Step response and Frequency response of a given plant.
8. Level Control system.
9. Temperature control system - ON/OFF Control.
10. a) Characteristics of magnetic amplifier.
    b) Step angle measurement for Stepper motor.
11. System simulator.

PART B

Any Two of the following simulation experiments are to be conducted using MATLAB

1. Stability Analysis (Root locus, Bode and Nyquist) for Linear Time Invariant systems.
2. a) Determining the Time Domain specifications for a second order system.
   b) Determining the Frequency Domain specifications for a second order system.
3. State space model for a given classical transfer function and its verification.
4. Compensator design (lag, lead and lag-lead).

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EE 318

LINEAR INTEGRATED CIRCUITS LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

After completing the lab course, the students will be able to

1. Analyze and design various applications of Op-Amp
2. Design and construct waveform generation circuits
3. Design and implement timer and analog and digital circuits using op amps.
4. Design and implement combinational logic circuits using digital IC's
5. Design and implement Active Filters, such as Low pass, High Pass, Band Pass for various cut off frequencies.

Course Outcomes:

The student will be able to:

1. Design and conduct experiments using op-amps, as well as analyze and interpret result.
2. Design basic application circuits using op-amp.
3. Analyze circuits for inverting and non-inverting amplifiers, diff. amps and comparators.
4. Recognize and make use of the DC & AC limitations of OP-AMPS.
5. Understand and implements the working of basic digital circuits.

LIST OF EXPERIMENTS:

PART - A

I. Generation of triangular, sine and square wave using IC's.
2. PLL (Phase locked loop).
3. Design of astable multi-vibrator using 555 timer.
4. Active filters.
5. Instrumentation amplifier-Sample and hold circuit.
6. Design of integrator and differentiator using Op-Amp.
7. Clippers and clampers using Op-Amps.
8. Monostable operation using IC's.
9. Boot-strap sweep circuit using Op-Amp.

PART - B

1. Multiplexer-application for logic realization and parallel to serial Conversions.
2. Synchronous counters. .
3. Asynchronous counters.
4. Half adder, full adder and subtractor and realization of combinational logic.
5. A/D converters.
6. D/ A converters.

Note: At least **SIX experiments** from **PART-A** and **FOUR** from **PART-B** should be conducted in the semester.

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SEM-II

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EE 321

ELECTRICAL MACHINERY-III

Instruction	4L+1T Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To study the principles of synchronous machines
2. To understand different types of alternator regulation methods for wound rotor, salient pole types and about their parallel operation.
3. To discuss about synchronous motor performance and its starting methods.
4. Impart knowledge about transient behavior of synchronous machines and their stability
5. To familiarize the construction details, principle of operation, prediction of performance of Electrical special machines

Course Outcomes: The student will be able to:

1. Apply basic principles of synchronous machines
2. Acquire the concepts of synchronous machine design.
3. Acquire knowledge about operation, regulation and parallel operation of alternators
4. Obtain the concepts of synchronous motor and stability analysis of synchronous machines
5. Acquire the concept of Electrical permanent magnet and special machines such as permanent magnet motors, switched reluctance motors, Hysteresis motors, stepper motor and BLDC motor.

UNIT-I

Synchronous Machines: Constructional Details, Types of windings, Winding factors, e.m.f. equation, Fractional pitch and fractional slot windings, Suppression of harmonics and tooth ripple, Armature reaction and reactance, Synchronous impedance.

UNIT-II

Synchronous Machine Design: Output equation, Main dimensions, short Circuit Ratio (SCR). Length of air gap calculation, selection of armature slots, design of field system and design of turbo alternators.

UNIT-III

Synchronous Generator: Voltage Regulation, Phasor diagram of alternator with nonsali ent poles, O.C. and S.C characteristics, Synchronous impedance, Ampere turn, ZPF methods for finding regulation, Principle of two reaction theory and its application for the salient pole synchronous machine analysis, Synchronism and parallel operation.

UNIT-IV

Synchronous Motor: Theory of operation, Vector diagram, Variation of current and power factor with excitation, Hunting and its prevention, Current and power diagram Predetermination of performance, Methods of Starting and Synchronizing. Synchronizing Power, Synchronous Condenser.

UNIT-V

Special Machines: Permanent Magnet Motors, Switched Reluctance Motors, Hysteresis Motors, Stepper motor

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and BLDC motor.

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Text Books:

1. P.S. Bhimbra Electrical machinery, Khanna Publications, 7th edition, 2003.
2. Nagrath I.J & Kothari D.P, Electrical Machines,Tata McGraw Hill Publications, Sigma series, 2006
3. H.Cotton, Advanced Electrical Technology, Wheeler & Co,7th edition, CBS publishers,2005. 4. J.B Gupta ,S.K. Kataria & Sons, Theory & performance of electrical machines,14th edition, 2014.

Suggested Reading:

1. Juha Pyrho¨ nen, Tapani Jokinen and Valeria Hrabovcova, Design of rotating electrical machines, John Wiley & Sons, Ltd. 2008
2. Fitzgerald, Kingsley, Umans, Electric Machinery, Tata Mc-Graw Hill Publications, 6th edition, 2002
3. Ashfaq husain, Danpatrai and sons, Electrical machines, 3nd edition, 2012

With effect from the academic year 2015-2016

EE322 *SWITCHGEAR AND PROTECTION*

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To analyze principles of operation of the different types of relays.
2. To comprehend the different principles of protective schemes in power system.
3. To understand the principles of operation of the different types of circuit breakers.
4. To be acquainted with different lightning arrestors and the appropriate circuit for the protection of the various components of power system

Course Outcomes: The student will be able to

1. Understand various components used in relays.
2. Analyze and Design the relay settings of over current and distance relays.
3. Differentiate between non-unit and unit protection schemes, and how the various associated parameters affect them.
4. Understand arc initiation and quenching mechanisms used in different circuit breakers.
5. Explain the causes, effects of over voltages and various protecting methods of the power system against over voltages.

Unit - I

Protective relays: Need for protection, Backup protection, Zones of protection, Definitions of relay pickup, dropout and reset values, Classification of relays, Operating principles and construction of electromagnetic and induction relays, Over current, Over voltage and Power relays, Directional features, Universal relay torque equation. Over current protection for radial feeders and ring mains, Protection of parallel lines, Relay settings for over Current relays, Earth fault and phase fault protection.

Unit - II

Static phase and Amplitude comparators: Characteristics of Dual input comparators, Distance protection, 3-step Distance relays, Characteristics Distance relays on the RX diagram, Sampling comparator, static over current relay, Microprocessor based over current relaying, Need of numerical relays, Advantages of numerical relays over solid state relays, Fundamentals of numerical relays, Functional block diagram of numerical relay.

Unit - III

Transformer and generator protection: Differential relays, Percentage differential relays, Protection of generator and transformer using percentage differential relays, Split phase, Inter turn protection, Overheating, Loss of excitation, Protection of generators, Protection of transformers against magnetizing inrush, Buchholz relay, Protection of earthing transformers, Generator transformer unit protection.

Unit - IV

Circuit breakers: Need for circuit breakers, Arc Properties, Principles of arc quenching theories, Recovery and Restriking voltages, Definitions in circuit breakers, Rated symmetrical and restricting asymmetrical breaking current, Rated making current, Rated capacity, Voltage and Frequency of circuit breakers, Current chopping,

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Resistance switching, Derivations of RRRV, Maximum RRRV etc., Circuit breaker calculations, Types of circuit breakers, Oil, Poor oil, Air, Air blast, SF6 and Vacuum circuit breakers, Testing of circuit breakers.

Unit - V

Over voltage protection: Protection of transmission lines against direct lightening strokes, Ground wires, Protection angle, Protection zones, Height of ground wire, Conductor clearances. Conductor heights, Tower footing resistance and its effects, Equipment protection assuming rod gaps, Arcing horns, Different types of lightening arrestors, Their construction, Surge absorbers, Peterson coil, Insulation coordination.

Text Books:

1. C.L. Wadhwa, Electrical Power System, Wiley Eastern Ltd., 2nd Edition, 2013
2. Badriram & Viswakarma, Power System Protection and Switchgear, Tata McGraw Hill, 2011.
3. Sunil S. Rao Switchgear and Protection, Khanna Publications, 2008
4. J.B. Gupta, Switchgear and protection, S.K. Kataria& Sons, 3rd Edition, 2014.

Suggested Reading:

1 B. Ravindranath, M. Chander , Power System Protection and Switchgear, New Age International, 2011.
2 OZA, Power System Protection and Switchgear, Tata McGraw Hill, 2010.

With effect from the academic year 2015-2016

EE 323 MICROPROCESSORS AND MICROCONTROLLERS

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To understand the Fundamentals of 8086 Microprocessors and its Programming.
2. To study the Interfacing of 8086 microprocessors using its various ports.
3. Fundamentals of 8051 Microcontroller, programming and its interfacing.
4. To know about the data converters and their interfacing with 8086 Microprocessor
5. To make students know about the various day-to-day applications of Microcontroller.

Course Outcomes: The student will be able to:

1. Understand the internal Architecture of both 8086 processor and 8051 microcontroller
2. Write assembly language programs on his own after gaining through knowledge of Instruction set.
3. Know how to establish communication between the processor/controller and peripheral devices.
4. Distinguish well between a Microprocessor and Microcontroller.
5. Write programs in assembly language with ease and co-relate them with high level language programs.

UNIT I

Introduction to Microprocessor and 8086 Microprocessor: Fundamentals of a microprocessor and its evolution, Architecture of 8086 Microprocessor- Segmented memory, Addressing modes, Instruction set, Pin diagram, Minimum and Maximum mode operations.

UNIT -II

Programming using 8086 Microprocessor: Assembly language programming (i.e . machine language programming), Assembler directives, simple programs using Assembler directives, strings, procedures, and Macros Timing.

UNIT -III

Interfacing with 8086 Microprocessor: Memory and I/O interfacing, A/D and D/A interfacing, 8255(PPI), Programmable Internal Timer (8253), Keyboard and display interface 8279, interrupts of 8086.

UNIT IV

Introduction to 8051 Microcontroller and its Programming: 8051 Microcontroller and its Architecture,

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I/O ports, Instruction set, Assembly language programming, connecting External memory.

UNIT V

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Interfacing with 8051 Microcontroller, interrupts and special function registers: Interrupts, serial I/O, Timers, Counters, Applications of microcontrollers-Interfacing LEDs, Seven Segment display, Keyboard Interfacing, Induction to PIC Microcontroller.

Text Books:

1. A.K.Ray and K.M.Burchandi, 'Advanced Microprocessors and peripherals' - Tata McGraw Hill Co., 2006
2. Mohammad Ali Mazidi and Janice Gillespie Mazidi"- The 8051 Microcontroller and Embedded Systems" using assembly and 'c'—prentice hall of India, 2008

Suggested Reading:

1. Douglas. V.Hall- Microprocessors and Interfacing – Tata McGraw Hill- revised edition,2006.
2. Krishna Kant – Microprocessors and Microcontrollers-Architecture, Programming and System Design 8085, 8086, 8051, 8096, Prentice – Hall India- 2007.
3. Kenneth.J. Ayala – "The 8051 Microcontroller Architecture, Programming and Applications ", Thomson publishers, 2nd edition.

With effect from the academic year 2015-2016

EE 324 **DIGITAL SIGNAL PROCESSING**

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To introduce basic concepts of signals and systems and representation of digital system.
2. To discuss DFT, DTFT, FFT, IFFT and Z transformation for the digital system analysis.
3. To make students familiar about design concepts of FIR and IIR filters.
4. To introduce digital signal processor.

Course Outcomes: The student will be able to:

1. Identify the digital system and find its response.
2. Compute and distinguish the DFT, DTFT, FFT and DFS of discrete systems.
3. Compute the Z transforms of discrete systems
4. Design FIR and IIR filter.
5. Be familiar with architecture and features of TMS 320F/2047 DSP.

UNIT-I

Introduction to Digital Signal Processing: 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.

UNIT-II

Fourier Analysis: Distinguishing Fourier transform of discrete singular & discrete Fourier transform, Discrete Fourier series, Phase and amplitude spectra, Properties of Discrete Fourier Transform, Linear Convolution of sequence using DFT, Frequency domain representation of discrete time system DTFT and DFT, Computation of DFT. Fast Fourier transform: Radix-2 decimation in time and decimation in frequency FFT algorithms, Inverse FFT.

UNIT-III

Z- Transform: Application of Z- Transforms for solution of difference equations of digital filters system function, stability criterion, Realization of filters, direct, canonic. Cascade and parallel form, linear phase realization, Introduction to Cosine Transform and Wavelet Transform.

UNIT-IV

IIR Filters: Design of Butterworth Chebyshev filters, IIR. filter design by impulse invariant bilinear transformation, impulse invariance method, step invariance method

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UNIT-V

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FIR Filters: Characteristics of FIR Digital Filters. Frequency response, comparison of FIR, IIR filters, Window techniques, Design of these filters using Rectangular, Hamming, Bartlet, Kaiser windows, Architecture and features of TMS 320F/2047 and ADSP signal processing chips, Applications of DSP.

Text Books:

1. P. VenkataRamani, M.Bhaskar, "Digital Signal Processo1; Architecture, Programming & Application ", TataMcGrawHill-2004
2. Avatar Singh, S.Srinivasan, "Digital Signal Processing, Thomson Publication, 2004.
3. Lafley," DSP Processing. fundamentals. architecture & features. S.Chand publishers & Co. 2000.
4. Johan G Peoahis, Dimitris G Manolakis, Digital signal processing, 5th eidition, Pearson prentice Hall, 2007

Suggested Reading:

1. Jackson L.B. Digital Filters and Signal Processing. Second edition, Kluwer Academic Publishers , 1989.
2. Oppenheim A V, and Schafer R. W. Digital Signal Processing –Prentice Hall Inc. 1975.
3. Tarun Kumar Rawat Digital Signal Processing first edition Oxford higher education, 2015
4. Anand kumar A, Digital Signal Processing, Second edition PHI learing, 2015.

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With effect from the academic year 2015-2016

EE 325 *POWER ELECTRONICS LAB*

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. To obtain and plot the characteristics of different static swi tches.
2. To design the triggering and commutation circuits for SCR.
3. To observe the effect of freewheeling in converters.
4. To familiarize the conversion principle of AC-DC, DC-DC, DC-AC and AC-AC conversion circuits and their applications.
5. To be acquainted with simulation of different power converters.

Course Outcomes: The student will be able to

1. Analyze the effects of control signals on static switches.
2. Distinguish the characteristics of different controlled switches and their applications.
3. Demonstrate the effects of freewheeling.
4. Acquainted with the conversion principles of AC-DC, DC-DC, DC-AC and AC-AC converters
5. Know how to use the simulation software to design different power electronic circuits.

PART-A

1. S.C.R. Characteristics
2. BJT, MOSFET and IGBT Characteristics
3. Gate triggering circuits for SCR using R, RC and UJT.
4. Single phase step down Cycloconverter with Rand RL loads.
5. A.C voltage controllers with R and RL loads.
6. Study of forced commutation techniques.
7. Two quadrant D.C drive.
8. Single phase fully controlled bridge rectifier with Rand RL loads.
9. Single phase half controlled bridge rectifier with Rand RL loads.
10. Buck and Boost choppers.
11. Study of 1 kVA UPS and SMPS for variable voltage with constant load, Constant voltage with variable load.
12. V/f control of AC drive.
13. Single phase inverter with R and RL Loads.

PART-B

1. Simulation of Single phase Full converter and Semi converter.
2. Simulation of Three phase Full converter and Semi converter.
3. Simulation of Single phase Inverter.
4. Simulation of Three phase Inverter.
5. Simulation of Single phase AC voltage controller.
6. Simulation of Single phase Cycloconverter.
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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EE 326 *MICROPROCESSORS & MICROCONTROLLERS LAB*

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. To write and execute simple programs using MASM software tool.
2. To get the students acquainted with the processor kit and improve their Programming skills
3. To make the students work with controller and understand how to program and get the desired output in different platforms.

Course Outcomes: The student will be able to:

1. Have command over basic assembly language programming.
2. Get familiarized with different assembly language software tools.
3. Know how a processor/controller will communicate with the External world
4. Do some mini projects.
5. understand other advanced Microcontrollers with basics of this basic Microcontroller

List of Experiments

For 8086Microprocessor:

Section 1: Using MASM/TASM (**Any 3 of** the below mentioned Expts. are to be conducted in this Section)

1. Programs for signed/unsigned multiplication and division.
2. Programs for finding average of N 16-bit numbers.
3. Programs for finding the largest number in an array.
4. Programs for code conversion like BCD numbers to 7-Segment.
5. Programs for computing factorial of a positive integer number.

Section 2: Using 8086 Kit(Interfacing) (**Any 2 of** the below mentioned Expts. are to be conducted in this Section)

1. 8255-PPI: Write ALP's to generate triangular, saw-tooth and square waveforms using DAC.
2. 8279-Keyboard Display: Write a small program to display a string of characters.
3. Write an ALP to display some alpha-numeric characters on a seven-segment display module.
4. Traffic Signal Controller.

For 8051 Microcontroller:

Section 3: Using 8051 Kit (**Any 3 of** the below mentioned Expts. are to be conducted in this section)

1. Data Transfer - Block move, Exchange, sorting, Finding largest element in an array.
2. Arithmetic Instructions :Multi byte operations
3. Boolean & Logical Instructions (Bit manipulations)
4. Use of JUMP and CALL instructions.
5. Programs to generate delay and programs using serial port and on chip timer/counter.

Section 4: Program Development using 'c' cross compiler for 8051 (**Any 2 of** the below mentioned Expts. are to be conducted in this section).

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.

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4. ADC interfacing for temperature monitoring.

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Major Equipment required for the LAB:

1. 8086 Microprocessor trainer kit(s) with in-built assembler/disassembler
2. 8051 Microcontroller trainer kit(s)
3. Interfacing Modules for both 8086 and 8051.
4. MASM Software and Kiel/Ride Cross-'c' compiler Software.

With effect from the academic year 2015-2016

EE 327 *ELECTRICAL MACHINES -II LAB*

Instruction		3 Periods per week Duration of
University Examination	3 Hours	
University Examination		50 Marks
Sessionals		25 Marks
Credits		2

Course Objectives:

1. To understand thoroughly Scott connection
2. To comprehend principles of regulation of alternator
3. To become familiar in operating the induction motor with various speed control methods.
4. To analyze the performance of three phase induction motor
5. To analyze the performance of synchronous motor.

Course Outcomes: The student will be able to:

1. Convert 3 supply to single phase supply
2. Synchronize alternator with grid.
3. Conclude better regulation method of synchronous generator.
4. Control the speed of 3Φ induction motor
5. Compensate reactive power of 3Φ induction motor.

List of Experiments:

1. Three phase to Two-phase conversion (Scott connection).
2. Heat run test on Three-phase transformer.
3. No-load test blocked rotor test and load test on 3-phase Induction motor.
4. Speed control of Three-phase Induction motor by any three of the following.
   a. Cascade connection b. Rotor impedance control c. Pole changing
   d. Rotor slip recovery, Kramer drive e. V/f control.
5. Parallel operation of Alternators.
6. Performance characteristics of Single -phase Induction motor.
7. Voltage regulation of Alternator by
a. Synchronous impedance method b. Ampere -turn method. c. Z.P.F. Method.
8. Regulation of Alternator by slip test.
9. Determination of V curves and inverted V curves of synchronous motor. 10. Power angle characteristics of a synchronous motor. 11. Load characteristics of Induction Generator.
12. P.F Improvement of Induction motor using capacitors.

Note: ATLEAST 10 EXPERIMENTS SHOULD BE CONDUCTED IN THE SEMESTER

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EE 351 *ELECTRICAL ENGINEERING MATERIALS*

(Elective -I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives: After the completion of the course the students should be able to:

1. Analyze the mechanical, magnetic and the electrical properties of materials.
2. Select materials for various engineering application.
3. Establish how failures occur in materials and how to prevent them.

Course Outcomes: The student will be able to

1. Classify the given material based on its properties.
2. Select a proper material for a given application.
3. Experiment on materials in order to test its adaptability
4. Investigate the suitability of material for the latest technological requirement
5. Compare and contrast the characte ristics of the materials.

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 magnetic materials, 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.

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Text Books:

1. G.K Benergy; Electrical and Electronic engineeri ng materials, PHI, 2014
2. Ian P. Jones; materials science for Electrical and Electronic Engineers, Oxford university press, 2008.

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3. R. K Sukhla: Electrical Engineering Materials, MC Graw Hill Education, 2013.

Suggested Readings:

1. Dhir: Electronic components & materials, MC Graw Hill education, 2012.
2. TTTI Mardras: Electrical Engineering materials, MC Graw Hill education, 2014.

EE 352 **OPTIMIZATION TECHNIQUES**

(Elective -I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 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.*
3. *To study non linear programming with gradient methods and direct search methods.*
4. *To study dynamic programming.*
5. *To study about Genetic algorithms, particle swarm optimization etc.*

Course Outcomes: The student will be able to :

1. *Acquire the knowledge of obtaining solution for classical optimization problems.*
2. *Acquire the concepts to formulate linear programming problem and get the solution with simplex method, Graphical method, Big-M method etc.*
3. *Acquire the knowledge to solve the nonlinear programming problems with various methods such as gradient methods, direct search methods, Fibonacci method and golden section method.*
4. *Acquire the knowledge to obtain the solution for dynamic programming problems.*
5. *Know the different selection mechanis ms in Genetic algorithms, preliminary idea of particle swarm optimization and their application to economic load dispatch.*

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 Pivotal condensation, Graphical method, Simplex algorithm, Big M method,

UNIT III

Non-Linear Programming: One dimensional Search method: Fibonacci method, Golden Section method.
Direct Search method: Uni-variate Search and Pattern Search methods,
Gradient method: Steepest Descent, Conjugate Gradient and Quasi- Newton method,

UNIT IV

Dynamic Programming: Multistage design process, Types, Principle of optimality, Computational procedure in Dynamic programming, Examples using Calculus method and Tabular method of solutions.

UNIT-V

Metaheuristic Techniques :Introduction to Genetic Algorithms, Encoding, Fitness Function, Basic Operators, Section Tournament Selection, Introduction to Particle Swarm Optimization (PSO), variations of PSO, Differential Evolution, Function optimization Formulation, DE fundamentals, Application to Economic load dispatch.

Text Books:

1. S.S.Rao, Engineering Optimization Theory and Applications, New Age International, 3rdEdition, 1998.
2. Jasbir S.Arora, Introduction to Optimum Design, McGraw Hill International Edition,1989.

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Suggested Reading:
1. Kalyamoy, Deb, Multi objective optimization using evolutionary algorithms, Wiley publicat ions.
2. S. Rajasekharam, G.A. Vijaya Lakshmi, Neural networks, Fuzzy logic and Genetic algorithms – Synthesis and Applications, PHI publications.

With effect from the academic year 2015-2016

EE 353 *ADVANCED CONTROL SYSTEMS*

(Elective -I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives: The objective of the course is to:

1. *Understand the method of representing continuous time systems and obtain solution. Transfer function from state model, state-transitions matrix and solution of state equation for discrete systems.*
2. *Understand the concepts of controllability and observability tests for continuous time, Discrete - time and time invariant systems. Also, study SISO system., Pole Placement by state Feedback.*
3. *Understand the importance of response of non-linear systems and construction of phase plane trajectories.*
4. *Understand the procedures to perform stability study using Lyapunov's criteria and construction of Lyapunov function.*
5. *Understand the procedure to formulate the optimal control problem and variational calculus using Hamitonian method.*

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

1. *Represent continuous time systems and obtain solution. Transfer function from state model, solution of state equation and state transition matrix for discrete time systems.*
2. *Follow the concepts of controllability and observability - tests for continuous time, discrete-time and time invariant systems. More importantly can carryout analysis of SOSO system. Pole placement by state feedback.*
3. *Analysis the response of non-linear systems and construction of phase plane trajectories.*
4. *Carryout the stability study through Lyapunov's criteria and construction of Lyapunov function.*
5. *Formulate the optimal control problem and variational calculus using Hamiltonian method.*

UNIT-I

Review of state-space: representation of continuous time systems and their solution, state models for discrete time systems described as difference Equations and transfer functions, Transfer function from State model, State - Transition matrix and solution of state equations for discrete time systems.

UNIT--II

Controllability and Observability: Concepts of Controllability and Observability, Controllability tests for continuous time, discrete-time, time-invariant systems. Observability tests for continuous time, discrete - time, time-invariant systems. And Controllability and Observability modes in State. Jordan's canonical form, Controllable and Observable companion forms for single input single output Systems, pole placement by State feedback.

UNIT-III

Nonlinear systems: Behavior of Nonlinear systems, jump resonance, Sub-harmonic oscillation, Limit cycles, common physical non-linearities, Singular points, phase plane-method, Construction of phase plane trajectories, Isoclines method, Delta method, Computation of time.

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UNIT-IV

Stability: Lyapunov's stability criteria, Theorems, Direct method of Lyapunov For linear systems, Non-Linear Systems, Methods of constructing Lyapunov function, Krasovki's Method, Variable gradient method.

UNIT-V

Optimal Control: Formulation of optimal control problem, calculus of variations, Minimization of functional. Formulation of variational calculus using Hamiltonian method.

Text Books:

1. Gopal.M., Modern Control System Theory, Wiley Eastern Limited, 2004.
2. Schulz D.G., Melsa J.L., State Functions Linear Control Systems, McGraw Hill.

Suggested Readings:

1. M. Gopal, Digital Control and State Variable Methods, Tata Mcgraw Hill, 2/e, 2003.
2. Ogata .K "Discrete Time control Systems", 2nd Edition, PHI publications, 1995

With effect from the academic year 2015-2016

EE 354 *RENEWABLE ENERGY SYSTEMS*

(Elective-1)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives: The objective of the course is to:

1. *Understand procedures and importance of Energy Planning, co-generation, Alternative energy sources, Energy Scenario in India in terms of percentage of different sources of energy.*
2. *Understand the importance Non-convential energy sources such as wind and solar in the context of power generation from these sources and plans of power sector as well as thrust given.*
3. *Understand the technical parameter of PV systems - stand alone as grid connected schemes also its advantages and limitations.*
4. *Understand the technical parameter of solar thermal energy systems, solar cooking systems as heating systems covering its maintenance.*
5. *Understand the importance of importance of wind energy in the context of power shortage and to identify possible location for installation, design aspects of wind turbine systems and energy derived from wind turbine.*

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

1. *Acquire knowledge required for Energy planning, importance of co-generation. Alternative energy sources and Energy scenario in India indicates in terms percentage of different sources of energy.*
2. *Significance and importance of non-convential energy source such as wind and solar in the context to generate more power from reviewable energy sources and the thrust the India power sector is giving.*
3. *Importance of solar PV systems – stand alone and grid connected scheme. Also advantages and limitations of solar PV technology.*
4. *Importance solar thermal energy systems. Solar cooking system and solar heating systems including maintenance aspect.*
5. *Importance of wind energy in the context of power shortage in Indian power sector, design aspects of wind turbine systems and energy designed for wind turbine – wind power generation installations.*

UNIT-I

Basics of Energy: Energy and Power, Estimation of Energy Bill, Characteristics of energy, Energy parameters, Ene rgy planning, cogeneration, classification of energy, Energy Resources, Alternative energy sources, Energy scenario in Indian context.

UNIT-II

Introduction to Energy Sources :Significance of non-conventional energy sources, solar energy, wind energy, energy from biomass and biogas, ocean energy, wave energy, Tidal energy, Geo thermal energy, fuel cell, MHD.

UNIT-III

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Solar photovoltaic technologies: Solar spectrum, extraterrestrial radiation, solar radiation at a given location, Advantages and limitations of solar PV technology, PV Technology, Basics of Technology, The amount of power generated, the rated power and actual power from a module, Generating more power using solar PV, Generating more power using solar PV – Protection of solar cells., Solar PV systems and their components, Solar PV lantern, Stand – alone PV systems, Home lighting and other usage, solar PV water pumping system.

UNIT-IV

Solar thermal technologies: Solar Thermal Energy Systems, Absorption and Radiation, Solar Cooking systems, Principle of Cooking, Cooking by Boiling, speed of cooking, Types of Solar Cooker, Solar Distillation System, Operation of Solar Distillation, Solar Heating Systems (Hot water), Principle of Conversion, Applications, Types of Heating systems, design and costing of solar heating systems., Maintenance.

UNIT-V

W ind Energy: Wind Flow, Motion of wind, vertical wind speed variation, distribution of wind speeds, Power in the wind, conversion of wind power- wind turbine, Worldwide wind Installations, Wind Turbine Sizing and systems design, energy derived from a wind turbine, annual energy production- approximate and accurate, estimation of required wind turbine power rating.

Text Books:

1. Chetan singh solanki: Renewable Energy Technology, PHI, 2009 A practical guide for begineers.
2. B H Khan: Non conventional Enginery & Resources, MC Graw Hill education, 2012.
3. Er. R.K.Rajput: Non-Conventional Energy Sources and Utilization, S.Chand Publishing, 2014.

Suggested Readings:

1. Garg & prakash: Solar Energy” Fundamentals & Applications, MC Graw Hill education 2012.
2. DP Kothari: Singal & Ranjan Renewable Energy Sources & Emerging Technologies, PHI 2014.
3. G.S.Sawhney: Non-Conventional Energy Resources, PHI learning pvt ltd., edition 2012.

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EE 328 *MINI PROJECTS*

Instruction	21 Periods
Duration of University Examination	3 Hours
University Examination	0 Marks
Sessional	25 Marks
Credits	1

Course Objectives: The objective of the course is to:

1. *Understand the methods to carryout mini project in the area pertaining to Electrical and Electronics Engineering.*
2. *Understand the procedures/ methods to formulate the project scope of work and collect required literature.*
3. *Familiarizing the way to problem formulation and identify suitable techniques to solve.*
4. *Summarize the results and draw the conclusions.*
5. *To get exposure in report writing and discuss the application aspect of the project.*

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

1. *Identify scope to carryout mini project in the area pertaining to Electrical and Electronics Engineering.*
2. *Formulate project scope and collect required information as literature survey.*
3. *Formulate problem to apply suitable techniques to solve.*
4. *Discuss the results and draw the conclusions*
5. *Discuss the aspect of suitable applications and also get exposure in report writing.*

Mini Project is a course that a student has to undergo during his/her academic term, which involves the student to explore in a discipline that belongs to their research interest wi thin their program area. It is a credit based course. The Mini Project shall be carried out during 6th semester along with other lab courses by having regular weekly slots. Students will take mini project batch wise and the batches will be divi ded as per the guidelines. The topic of mini project should be so selected enabling the students to complete the work in the stipulated time with the available resources in the respective laboratories. The scope of the mini project could be handling part of the consultancy work, maintenance of the existing equipment, development of new experiment setup or can be a prelude to the main project with a specific outcome.

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EE 329 *INDUSTRY VISIT*

Least 3 days in semester	3 x 8 =24 hours
Sessional /Examination	*Grade

Course Objectives: The objective of the course is to:

1. *Physically see the process of manufacturing procedure and steps involved.*
2. *Collect the information in respect of materials, sources of supply.*
3. *Understand the sequential stages involved in manufacturing process.*
4. *Understand the procedure to write the 'industry visit' technical report by compiling all the information collected during the visit.*
5. *Understand the safety procedures and pre-cautions followed in Industry, confidentiality of the process and the man power required.*

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

1. *Know the importance of visiting an engineering industry from the point of view of process of manufactory procedures and set-up.*
2. *Summarize the required information with regard to materials, source of supply in respect of a product.*
3. *Know the stages in manufactory of a product*
4. *Prepare the 'industry visit' technical report covering the details of visit and it importance.*
5. *Visualize the safety precautions to be follow in industry, confidentiality of the product processing as the man power required.*

Students are expected to visit at least two industries during the semester and submit a detailed technical report on the study -visits to the Department. The Department should evaluate the reports through a Committee consisting of Head of the Department and two more faculty members to award the Grades *.

*Excellent /Very Good/Good /Satisfactory /Unsatisfactory.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
SCHEME OF INSTRUCTIONS- Dept. of EEE

III YEAR (2015-16 Academic year)

I SEMESTER

THEORY						
S.No	**Code**	**Subject**	**L**	**T**	**P**	**Credits**
1	EE 311	Power Systems – II	4	0	0	3
2	EE 312	Electrical Machinery – II	4	1	0	3
3	EE 313	Linear Control Systems	4	1	0	3
4	EE 314	Power Electronics	4	1	0	3
5	EE 315	Linear Integrated Circuits	4	0	0	3
6	CE 444	Human Values and Professional Ethics	2*	0	0	0
PRACTICALS						
7	EE 316	Electrical Machinery – I Lab	0	0	3	2
8	EE 317	Control Systems Lab	0	0	3	2
9	EE 318	Linear Integrated Circuits Lab	0	0	3	2
		TOTAL	**22**	**03**	**09**	**21**

*21 Periods per semester

II Semester

THEORY						
S.No	**Code**	**Subject**	**L**	**T**	**P**	**Credits**
1	EE 321	Electrical Machinery - III	4	1	0	3
2	EE 322	Switch Gear & Protection	4	0	0	3
3	EE 323	Microprocessor & Microcontrollers	4	0	0	3
4	EE 324	Digital Signal Processing	4	1	0	3
5	 EE 351 EE 352 EE 353 EE 354	Elective – I 1. Electrical Engineering Materials 2. Optimization Techniques 3. Advanced Control System 4. Renewable Energy Systems	4	0	0	3
PRACTICALS						
6	EE 325	Power Electronics Lab	0	0	3	2
7	EE 326	Microprocessor & Microcontrollers Lab	0	0	3	2
8	EE 327	Electrical Machinery – II Lab	0	0	3	2
9	EE 328	Mini Project *	0	0	0	1
10		Industry Visit *	0	0	0	Grade
		TOTAL	**20**	**02**	**09**	**22**

* Only internal evaluation

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SEM-I

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EE 311 *POWER SYSTEMS - II*

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives

1. *To understand Inductance and capacitance calculations for different line configurations*
2. *To understand per unit system representation in power systems.*
3. *To understand the importance of transmission line representation in terms of short, medium and long lines in finding performance of lines*
4. *To understand the importance of symmetrical and un-symmetrical faults in power systems.*
5. *To study the causes of over voltages and bewley lattice diagram.*

Course Outcomes: The student will be able to

1. *Acquire knowledge in calculation of inductance and capacitance of lines*
2. *Acquire knowledge to represent the power system data in per unit and consider appropriate line models to find the performance of transmission lines*
3. *Acquire the concepts of corona and effect of corona in power system.*
4. *Acquire knowledge to study different types of faults, and its relevance in relay settings.*
5. *Acquire knowledge in finding the transmission line wave equation and able to find various coefficients of lines and draw the Bewley Lattice diagram.*

UNIT-I

Line Parameter Calculations: Calculating Inductance & Capacitance of Transmission Lines, single phase and three phase symmetrical composite conductors, GMD, GMR, Transposition of conductors, Bundled conductors, effect of earth capacitance.

UNIT-II

Modeling of Transmission Lines: Short, medium, long lines, Line calculations, Tuned Lines, Surge impedance loading.

Corona: Causes, Disruptive and Visual Critical Voltages, Power loss, minimization of Corona effects.

UNIT-III

Per Unit System of Representation: Use of per unit quantities in power systems, Advantages of per unit system.

Symmetrical Faults: Short Circuit Currents, Reactance of Synchronous Machines, fault Calculations, Short circuit capacity of a bus.

UNIT-IV

Unsymmetrical Faults: Symmetrical components of unsymmetrical Phasors, Power in terms of symmetrical components, 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-V

Transients in Power Systems: Causes of over voltages. Travelling Wave Theory, Wave equation, Reflection and refraction Coefficients, Junction of Cable and overhead lines, Junction of three lines of different natural impedances, Bewley Lattice diagram.

Text Books

1. C.L. Wadhwa, Electrical Power Systems, Wiley Eastern Ltd., 4dtEdition, 2006
2. I.J. Nagrath & D.P.Kothari Modern Power Systems Analysis, TMH Edition, 2003.

Suggested Reading

1. John J. Grainger William D.Stevenson Jr. Power System Analysis, Tata McGraw Hill Edn. 2003
2.A.Chakrabarti, M.L.Soni, P. V.Gupta, U.S.Bhatnagar, A Text book on Power System, Dhanpat Rai & Co (P) Ltd -1999.

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EE 312 **ELECTRICAL MACHINERY-II**

Instruction	4L+1T Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To study the principles of tap changing, tests and auto-transformer.
2. To understand different types of three phase induction motors.
3. To discuss about speed control and starting methods of three phase induction motors.
4. To analyze unbalanced operation of three phase induction motors and three phase transformers .
5. To familiarize the construction details, principle of operation, prediction of performance of single phase induction motors.

Course Outcomes: The student will be able to:

1. Apply basic principles of tap changing and auto-transformer.
2. Acquire knowledge about operation and performance analysis of three phase induction motors .
3. Obtain the concepts of speed control and starting methods of three phase induction motors .
4. Analyze unbalanced operation of three phase induction motors and three phase transformers .
5. Acquire the concept of single phase induction motors.

UNIT-I

Transformers: Cooling arrangement in Transformers. Testing of Transformers, Routine Tests and Special tests, Measurement of Voltage ratio and check for voltage vector relationship. Measurement of Insulation resistance. Maintenance of Transformers. Tap changer on transformers, No-load tap changer, On-load tap changer. Third harmonic voltages and tertiary winding in three phase transformers, Auto Transformer, Comparison with two winding transformers, Conversion of two winding transformer to auto transformer.

UNIT-II

Three-phase Induction Motor: Constructional features, Rotating Magnetic field theory, Principle of operation of squirrel cage and slip ring motors, Vector Diagram, Equivalent circuit, Expression for torque, Starting torque, Maximum torque, Slip/Torque characteristics, Performance characteristics, Equivalent circuits from test, Current loci circle diagram, Predetermination of characteristics of Induction Motors. **UNIT-III**

Starting methods of Induction motors: Modes of operation, torque and power limits of Induction motors, Speed control methods, Resistance Control, Voltage control, pole changing, Cascading, variable frequency control, Slip power recovery schemes Kramer drive. Scherbius drive, Double cage Induction motors, Induction generator, Doubly fed Induction Generator.

UNIT-IV

Unbalanced Operation: Voltage Unbalance, Unbalanced Operation of 3-phase Induction Motor, Per Phase Equivalent Circuits, Single Phasing, Unbalanced Operation of 3-Phase Transformers, Single-phase load on Three-phase transformers Single Phasing in 3-phase transformers- Delta /Star and Star/Delta transformers.

UNIT-V

Single Phase motors: Single phase motors, Theory and operation of single phase motors, Shaded pole, Split phase and capacitor motors, Compensated and uncompensated series and repulsion motors. Linear Induction motors.

Text Books:

1. P.S. Bhimbra Electrical machinery, Khanna Publications, 7th edition, 2003.
2. Nagrath I.J & Kothari D.P, Electrical Machines, Tata McGraw Hill Publications, Sigma series, 2006.
3. H.Cotton, Advanced Electrical Technology, Wheeler & Co,7th edition, CBS publishers,2005.
4. Theory and performance of electrical machines by J.B Gupta ,S.K. Kataria & Sons,14th edition,2014.

Suggested Reading:

1. Juha Pyrho¨ nen, Tapani Jokinen and Valeria Hrabovcova, Design of rotating electricalmachines, John Wiley & Sons, Ltd. 2008.
2. Fitzgerald, Kingsley, Umans, Electric Machinery, Tata Mc-Graw Hill Publications, 6th edition, 2002.
3. Electrical machines by Ashfaq husain, Danpatrai and sons, 3nd edition, 2012

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EE 313 LINEAR CONTROL SYSTEMS

Instruction	4L + 1T Periods per week
Duration of Semester Examination	3Hours
Semester Examination	75Marks
Sessional	25Marks
Credits	3

Course Objectives:

1. To understand different types of linear control systems and their mathematical modeling.
2. To study the transfer functions of control system components
3. To study Stability analysis, both in time and frequency domains
4. To study the concepts of State space representation of Linear Time invariant systems (LTI)

Course Outcomes: The student will be able to:

1. Build different mathematical models for any LTI physical /electrical syste ms
2. Derive the transfer function of components used in feedback control systems
3. Apply the concepts of stability analysis in time and frequency domains, which is essential to analyze any system performance.
4. Apply the concepts of state space controls
5. Design conventional controllers and compensators used for closed loop performance.

UNIT I

Introduction: Concepts of control systems- Open loop and closed loop control systems and their differences, Different examples of control systems, Classification of control systems, Feedback Characteristics, Effects of feedback. Mathematical models, Differential equations, Impulse Response and transfer functions, Translational and Rotational mechanical systems, Analogous systems.

UNIT -II

Transfer Function Representation: Two Phase Serve motor characteristics, Transfer Function of DC and AC Servo motor, Potentiometers, Synchro transmitter and Receiver, Tacho generator, Stepper Motor characteristics, Block diagram algebra , signal flow graphs and problems.

UNIT -III

Time Response Analysis: Standard test signals, Time response of first/second order systems, Transient response of second order system for step input. Time domain specifications, Types of systems, static error coefficients, Routh-Hurwitz criterion of stability, Root locus technique, Typical systems analyzed by root locus technique, Effect of location of roots on system response, PID Controllers.

UNIT IV

Frequency Response Analysis: Introduction, Frequency domain specifications for a second order system, Bode plots, Stability Analysis from Bode plots. Polar plots, Nyquist criterion for stability. Compensation techniques, Lag, Lead, Lead-Lag Controllers design in frequency domain.

UNIT V

State Space Representation: Concept of state, state variable, state models of linear time invariant systems, Derivation for state models from transfer functions and differential equations, State transition matrix-solution of state equations by time domain method. Obsevability and Controllability, Introduction to discrete control systems.

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.

Suggested Reading:

1. M.Gopal, Control Systems Principles and Design- Tata McGraw Hill, 2nd Edition, 2003.
2. N.C Jagan-control Systems, 2nd Edition, BS Publications, 2008
3. N. Nise, Control Systems Engineering, 6th edition, Willey Publications, 2011.
4. Linear Control System analysis and design with MATLAB, Taylor & Francis D'Azzo- Control Systems, 2009

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EE 314 *POWER ELECTRONICS*

Instruction	4L+1T Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objective: The objective of the course is to

1. Introduce the characteristics of various power semiconductor switches and their applications.
2. Make acquainted with the operating principles of AC-DC, DC-DC, AC-AC and DC-AC converters, methods of voltage control and converters applications.

Course Outcomes: The student will be able to:

1. *Gain knowledge of basic operation of various power semiconductor devices and to comparetheir characteristics.*
2. *Design protection circuit and control circuits for SCR.*
3. *Acquaint with the principles of phase controlled converters.*
4. *Analyze the operation principles of different DC-DC, AC-AC converters.*
5. *Identify different topologies of DC-AC converters.*

UNIT-I

Power Diodes and Transistors: Power diode, characteristics, Recovery characteristics, Types of power diodes, General purpose diodes, Fast recovery diodes, their applications. Bipolar Junction Transistors(BJT), Power MOSFETs, IGBTs-Basic structure and working, Steady state and switching characteristics, 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

Principles of phase controlled converters: Study of Single -phase and three-phase half waveand 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, Introduction to Buck, Boost and Buck-Boost regulators.

AC-AC Converters:

Principle of operation of Single phase Cyclo-converters and their applications. Single -phase AC Voltage Controllers with R and RL loads.

UNIT-V

Inverters: Principle of operation of Single -phase Inverters, Voltage control methods, Single pulse width modulation, Multiple pulse width modulation, Sinusoidal pulse width modulation, Comparison of Voltage Source Inverters and Current Source Inverters, Three -phase bridge Inverters, 180^0 & 120^0 modes of operation.

Text Books:

1. Singh.M.D and Khanchandani.K.B,Power Electronics, Tata McGraw Hill, 2nd Edition, 2006.
2. Rashid.M.H. Power Electronics Circuits Devices and Applications. Prentice Hall of India, 2003
3. Bimbra.P.S, Power Electronics, Third Edition, Khanna Publishers, 2013

Suggested Reading:

1. Mohan, Undeland , Robbins, Power Electronics, John Wiley, 1996.
2. P.C.Sen, Power Electronics, Tata Mc-Graw Hill, 1st Edition, 2001.

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EE 315 *LINEAR INTEGRATED CIRCUITS*

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To study the characteristics of operational amplifiers, stability, basic applications such as integrator, differentiator etc.,
2. To study the different applications of operational amplifiers in voltage limiter, Schmitt trigger, instrumentation circuits.
3. To study the concepts of waveform generation, sine, square, triangular using op-amps.
4. To study the operation of 555 timer as a monostable and an astable multivibrator.
5. To study different types of voltage regulator, Filters and their characteristics.

Course Outcomes: The student will be able to:

1. Understand the basic characteristics of op-amps and their significance.
2. Analyze a typical op-amp equivalent circuit by calculating its voltage gain and input resistance.
3. Define stability for a amplifier circuit.
4. Analyze an instrumentation amplifier circuit and discuss its applications.
5. Analyze higher order filter circuits and explain their significance.
6. Analyze and design voltage regulators (Fixed voltage and adjustable voltage).

UNIT-I

Operational Amplifiers Characteristics: open loop voltage gain, output impedance, input impedance, common mode rejection ratio, Offset balancing techniques, Slew rate, Frequency response, Stability, frequency compensation of Op-amp.

Basic OP-Amp Applications: inverter summer, analog integrator, differentiator, current to voltage converter, voltage to current converter, voltage follower, ac amplifier.

UNIT-II

OP-Amp Applications: Voltage limiter, clipper & clamper, precision rectifier, full wave and half wave, peak detector, comparator, zero crossing detector, Schmitt trigger, monostable, astable, bistable multiplier, divider, difference amplifier instrumentation amplifier circuits using Op- amps.

UNIT-III

W aveform Generation using Op-Amps: Sine, Square, Triangular and Quadrature oscillators, voltage controlled oscillator / multi vibrator, voltage to frequency converter, 555 timer functional diagram, operation as monostable and astable. phase locked loop, A/D and D/ A converters.

UNIT-IV

Voltage Regulators: Series voltage regulator using Op-amp, shunt regulators using Op-amp, switching regulators using Op-amp, dual voltage regulator, fixed voltage regulators, dual tracking regulators, hybrid regulator, current sensing and current feedback protection.

UNIT-V

Filters: RC active filters, low pass, high band pass, band reject, notch, first order, second order transformation, state variable filter, switched capacitor filter, universal filter , Balanced modulator/ demodulator.

Text Books:

1. D.Roy Choudhury, Linear Integrated Circuits, Shail B.Jain, 3rd Edition, New Age International(P) Ltd., 2007.
2. Malvino Albert Paul, Electronic Principles, 7th Edition, Tata McGraw Hill, 2006
3. Coughlin and Driscoll, Operational Amplifiers and Linear integrated Circuits, 6th Edition, Prentice hall of India 2003.

Suggested Reading:

1. Gayakwad R.A. Op-Amps and Linear Integrated Circuits, 4th Edition, Prentice Hall of India, 2002.
2. David A. Bell, Operational Amplifiers and Linear IC s, PHI, 2003.

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CE 444 *HUMAN VALUES AND PROFESSIONAL ETHICS*

Instructions	: 21 Periods per semester (7*3)
Duration of University Examination	: 2 Hours
University Examination	: 50 Marks
Sessional	: Nil
Credits	: Nil

Course Objectives:

1. To develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. To enable the students understand the values, the need for value adoption and prepare them meet the challenges
3. To enable the students develop the potential to adopt values, develop a good character and personality and lead a happy life
4. To motivate the students practice the values in life and contribute for the society around them and for the development of the institutions /organisation around they are in.
5. To make the students understand the professional ethics and their applications to engineering profession

Course Outcomes

1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, convert everything into happiness and contribute for the happiness of others.
4. Students become potential sources for contributing to the development of the society around them and institutions / organisations they work in.
5. Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

UNIT-1 Concepts and Classification of Values -Need and challenges for value Adoption

Definition of Values – Concept of Values – Classification of Values – Hierarchy of Values – Types of Values –Espoused and Applied Values – Value judgement based on Culture – Value judgement based on Tradition – Interdependence of Values

Need for value education – Findings of Commissions and Committees - Corruption and illegal practices – Science and Technology without values- Exploitation of nature – Increasing use of violence and intoxicants – Lack of education in values – Implications of education in values – Vision for a better India

Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges

UNIT - 2: Personal Development and Values in Life

Personal Development: Enlightened self-interest – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity – The quest for Character – Tests of Character – The key to good character

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Values in Life: Building an ethical policy – Integrating values in everyday life – Archaic Social Values – Parenting practices – Critical Thinking - Analyzing and Prioritizing values – Practicing Yoga and Meditation

UNIT - 3: Practicing Values for the development of Society

Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atroci ties – Environmental awareness – Working for the Sustainable development of the society

Values in Education system: Present Scenario- Engineering education –Current trends- Need for quality improvement- Adoption of value education – Principles of Integri ty-Institutional Development.

UNIT - 4: Basic Concepts of Professional Ethics

Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional ethics, Ethical dilemmas, Indian and Global thoughts on ethics, Profession, Professional and Professionalism, Ethical role of a professional Basic ethical principles, Some basic ethical theories, use of ethical theories.

Science, Religion Ethics, Genders and ethics, Media and ethics, Computer Ethics, Case Studieson Professional Ethics, Exemplary life sketches of prominent Indian personalities

UNIT-5: Ethics in engineering profession

Engineering profession-Technology and Society-Engineering as Social Experimentation-Engineering ethics-Ethical obligations of Engineering Professionals-Role of Engineers-Engineers as Managers-Professional responsibilities of Engineers- Engineers Responsibility for Safety- A few Case Studies on Risk management

Conflicts of Interest- Occupational Crimes- Plagiarism-Self plagiarism-Ethics Audit-Consideration for ethics audit-Ethics Standards and Bench Marking

Text Books:

1. Subramanian R., “ Professional Ethics “ , Oxford University Press , 2013
2. Nagarajan R.S., “ A Text Book on Human Values and Professional Ethics “ New Age Publications , 2007
3. Dinesh Babu S., “ Professional Ethics and Human Values “ , Laxmi Publications , 2007

Reference Books:

4. SantoshAjmera and Nanda Kishore Reddy “ Ethics , Integrity and Aptitude “ ,McGrawhill Education Private Limited , 2014
5. GovindaRajan M., Natarajan S., Senthil Kumar V.S.” Professional Ethi cs and Human Values “ Prentice Hall India Private Limited ,2012
6. Course Material for Post Graduate Diploma In “Value Education & Spirituality “ Prepared by Annamalai University in Collaboration with Brahma Kumaris , 2010

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EE 316 *ELECTRICAL MACHINES -I LAB*

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. To understand the performance & Load characteristics of different types of DC generators & Motors.
2. To understand the procedure to separate core losses in a single phase transformer, perform OC and SC test on transformer and conduct Sumpner's test on two identical transformers.
3. To understand the procedure to estimate the efficiency of DC machine by Hopkinson test.
4. To understand the control procedure and vary speed of DC shunt motor.
5. To understand the process of dynamic braking.

Course Outcomes: The student will be able to:

1. Acquire requisite knowledge to evaluate and compare the characteristics and performance aspects of different types DC generators and motors by conducting suitable tests.
2. Acquire knowledge to analyze the single phase transformer by performing the suitable tests.
3. Gain practical knowledge to know different losses and efficiency in DC machine and their dependence on other parameters such as speed, field current etc., and also calculate efficiency at different loads.
4. Gain knowledge to perform speed control of DC shunt motor
5. Calculate moment of inertia of DC machine through retardation curve.

List of Experiments:

1. Magnetization characteristics and the speed verses voltage curve of separately and self excited D.C. generator
2. Load characteristics of separately excited and self excited Shunt Generators
3. Load characteristics of DC Compound generator

4. Performance characteristics of Series Motor
5. Swinburne's Test & Performance characteristics of D.C. shunt motor.
6. Performance characteristics of DC Compound motor

7. Separation of iron and friction losses and estimation of parameters in D.C. machines.
8. Speed control of D.C. shunt motor by shunt field control and armature resistance control
9. Separation of core losses in a Single Phase transformer

10. Open circuit and short circuit tests on a Single Phase transformer

11. Sumpner's test on two identical transformers
12. Estimation of efficiency of DC Machine by Hopkinson test.
13. Retardation Test, Dynamic Braking of DC Shunt Motors.

Note: ATLEAST 10 EXPERIMENTS SHOULD BE CONDUCTED IN THE SEMESTER

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EE 317 CONTROL SYSTEMS LAB

Instruction	3 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	50Marks
Sessional	25Marks
Credits	2

Course Objectives:

1. To understand the characteristics of DC, AC Servo Motors and synchro pair.
2. To understand the frequency response of compensating networks.
3. To study the closed loop performance for given plant using
   i) P, PI and PID controllers ii) ON/OFF controller.

Course Outcomes: The student will be able to

1. Obtain DC, AC Servo Motors and Synchro pair characteristics.
2. Design, Analyze and Simulate performance of a given second order plant from frequency and time response point of view.
3. Gain knowledge in visualizing the designing, functioning and simulation of compensators in improving the stability of the system.
4. Determine the time and frequency domain specifications of second order system
5. Acquire knowledge in analyzing the performance of P, PI, PID and ON/OFF controller and to distinguish the merits and de-merits of different types of controllers in closed loop environment.

List of Experiments:

PART A

Any Eight of the following experiments are to be conducted

1. Characteristics of D.C Servo motor.
2. Characteristics of A.C. Servo motor.
3. Characteristics of Synchro Pair.
4. Step response of second order system.
5. Frequency response of compensating networks.
6. Closed loop P, PI and PID Controller for temperature of a given plant.
7. Step response and Frequency response of a given plant.
8. Level Control system.
9. Temperature control system - ON/OFF Control.
10. a) Characteristics of magnetic amplifier.
    b) Step angle measurement for Stepper motor.
11. System simulator.

PART B

Any Two of the following simulation experiments are to be conducted using MATLAB

1. Stability Analysis (Root locus, Bode and Nyquist) for Linear Time Invariant systems.
2. a) Determining the Time Domain specifications for a second order system.
   b) Determining the Frequency Domain specifications for a second order system.
3. State space model for a given classical transfer function and its verification.
4. Compensator design (lag, lead and lag-lead).

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EE 318

LINEAR INTEGRATED CIRCUITS LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

After completing the lab course, the students will be able to

1. Analyze and design various applications of Op-Amp
2. Design and construct waveform generation circuits
3. Design and implement timer and analog and digital circuits using op amps.
4. Design and implement combinational logic circuits using digital IC's
5. Design and implement Active Filters, such as Low pass, High Pass, Band Pass for various cut off frequencies.

Course Outcomes:

The student will be able to:

1. Design and conduct experiments using op-amps, as well as analyze and interpret result.
2. Design basic application circuits using op-amp.
3. Analyze circuits for inverting and non-inverting amplifiers, diff. amps and comparators.
4. Recognize and make use of the DC & AC limitations of OP-AMPS.
5. Understand and implements the working of basic digital circuits.

LIST OF EXPERIMENTS:

PART - A

I. Generation of triangular, sine and square wave using IC's.
2. PLL (Phase locked loop).
3. Design of astable multi-vibrator using 555 timer.
4. Active filters.
5. Instrumentation amplifier-Sample and hold circuit.
6. Design of integrator and differentiator using Op-Amp.
7. Clippers and clampers using Op-Amps.
8. Monostable operation using IC's.
9. Boot-strap sweep circuit using Op-Amp.

PART - B

1. Multiplexer-application for logic realization and parallel to serial Conversions.
2. Synchronous counters. .
3. Asynchronous counters.
4. Half adder, full adder and subtractor and realization of combinational logic.
5. A/D converters.
6. D/ A converters.

Note: At least **SIX experiments** from **PART-A** and **FOUR** from **PART-B** should be conducted in the semester.

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SEM-II

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EE 321

ELECTRICAL MACHINERY-III

Instruction	4L+1T Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To study the principles of synchronous machines
2. To understand different types of alternator regulation methods for wound rotor, salient pole types and about their parallel operation.
3. To discuss about synchronous motor performance and its starting methods.
4. Impart knowledge about transient behavior of synchronous machines and their stability
5. To familiarize the construction details, principle of operation, prediction of performance of Electrical special machines

Course Outcomes: The student will be able to:

1. Apply basic principles of synchronous machines
2. Acquire the concepts of synchronous machine design.
3. Acquire knowledge about operation, regulation and parallel operation of alternators
4. Obtain the concepts of synchronous motor and stability analysis of synchronous machines
5. Acquire the concept of Electrical permanent magnet and special machines such as permanent magnet motors, switched reluctance motors, Hysteresis motors, stepper motor and BLDC motor.

UNIT-I

Synchronous Machines: Constructional Details, Types of windings, Winding factors, e.m.f. equation, Fractional pitch and fractional slot windings, Suppression of harmonics and tooth ripple, Armature reaction and reactance, Synchronous impedance.

UNIT-II

Synchronous Machine Design: Output equation, Main dimensions, short Circuit Ratio (SCR). Length of air gap calculation, selection of armature slots, design of field system and design of turbo alternators.

UNIT-III

Synchronous Generator: Voltage Regulation, Phasor diagram of alternator with nonsalient poles, O.C. and S.C characteristics, Synchronous impedance, Ampere turn, ZPF methods for finding regulation, Principle of two reaction theory and its application for the salient pole synchronous machine analysis, Synchronism and parallel operation.

UNIT-IV

Synchronous Motor: Theory of operation, Vector diagram, Variation of current and power factor with excitation, Hunting and its prevention, Current and power diagram Predetermination of performance, Methods of Starting and Synchronizing. Synchronizing Power, Synchronous Condenser.

UNIT-V

Special Machines: Permanent Magnet Motors, Switched Reluctance Motors, Hysteresis Motors, Stepper motor and BLDC motor.

Text Books:

1. P.S. Bhimbra Electrical machinery, Khanna Publications, 7th edition, 2003.
2. Nagrath I.J & Kothari D.P, Electrical Machine s,Tata McGraw Hill Publications, Sigma series, 2006
3. H.Cotton, Advanced Electrical Technology, Wheeler & Co,7th edition, CBS publishers,2005.
4. J.B Gupta ,S.K. Kataria & Sons, Theory & performance of electrical machines,14th edition, 2014.

Suggested Reading:

1. Juha Pyrho¨ nen, Tapani Jokinen and Valeria Hrabovcova, Design of rotating electrical machines, John Wiley & Sons, Ltd. 2008
2. Fitzgerald, Kingsley, Umans, Electric Machi nery, Tata Mc-Graw Hill Publications, 6th edition, 2002
3. Ashfaq husain, Danpatrai and sons, Electrical machines, 3nd edition, 2012

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EE322 *SWITCHGEAR AND PROTECTION*

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To analyze principles of operation of the different types of relays.
2. To comprehend the different principles of protective schemes in power system.
3. To understand the principles of operation of the different types of circuit breakers.
4. To be acquainted with different lightning arrestors and the appropriate circuit for the protection of the various components of power system

Course Outcomes: The student will be able to

1. Understand various components used in relays.
2. Analyze and Design the relay settings of over current and distance relays.
3. Differentiate between non-unit and unit protection schemes, and how the various associated parameters affect them.
4. Understand arc initiation and quenching mechanisms used in different circuit breakers.
5. Explain the causes, effects of over voltages and various protecting methods of the power system against over voltages.

Unit - I

Protective relays: Need for protection, Backup protection, Zones of protection, Definitions of relay pickup, dropout and reset values, Classification of relays, Operating principles and construction of electromagnetic and induction relays, Over current, Over voltage and Power relays, Dir ectional features, Universal relay torque equation. Over current protection for radial feeders and ring mains, Protection of parallel lines, Relay settings for over Current relays, Earth fault and phase fault protection.

Unit - II

Static phase and Amplitude comparators: Characteristics of Dual input comparators, Distance protection, 3-step Distance relays, Characteristics Distance relays on the RX diagram, Sampling comparator, static over current relay, Microprocessor based over current relaying, Need of numerical relays, Advantages of numerical relays over solid state relays, Fundamentals of numerical relays, Functional block diagram of numerical relay.

Unit - III

Transformer and generator protection: Differential relays, Percentage differential relays, Protection of generator and transformer using percentage differential relays, Split phase, Inter turn protection, Overheating, Loss of excitation, Protection of generators, Protection of transformers against magnetizing inrush, Buchholz relay, Protection of e arthing transformers, Generator transformer unit protection.

Unit - IV

Circuit breakers: Need for circuit breakers, Arc Properties, Principles of arc quenching theories, Recovery and Restriking voltages, Definitions in circuit breakers, Rated symmetrical and restricting asymmetrical breaking current, Rated making current, Rated capacity, Voltage and Frequency of circuit breakers, Current chopping, Resistance switching, Derivations of RRRV, Maximum RRRV etc., Circuit breaker calculations, Types of circuit breakers, Oil, Poor oil, Air, Air blast, SF6 and Vacuum circuit breakers, Testing of circuit breakers.

Unit - V

Over voltage protection: Protection of transmission lines against direct lightening strokes, Ground wires, Protection angle, Protection zones, Hei ght of ground wire, Conductor clearances. Conductor heights, Tower footing resistance and its effects, Equipment protection assuming rod gaps, Arcing horns, Different types of lightening arrestors, Their construction, Surge absorbers, Peterson coil, Insulation coordination.

Text Books:

1. C.L. Wadhwa, Electrical Power System, Wiley Eastern Ltd., 2nd Edition, 2013
2. Badriram & Viswakarma, Power System Protection and Switchgear, Tata McGraw Hill, 2011.
3. Sunil S. Rao Switchgear and Protection, Khanna Publications, 2008
4. J.B. Gupta, Switchgear and protection, S.K. Kataria& Sons, 3rd Edition, 2014.

Suggested Reading:

1 B. Ravindranath, M. Chander , Power System Protection and Switchgear, New Age Internationals 2011.

2 OZA, Power System Protection and Switchgear, Tata McGraw Hill, 2010.

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EE 323 **MICROPROCESSORS AND MICROCONTROLLERS**

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To understand the Fundamentals of 8086 Mi croprocessors and its Programming.
2. To study the Interfacing of 8086 microprocessors using its various ports.
3. Fundamentals of 8051 Microcontroller, programming and its interfacing.
4. To know about the data converters and their interfacing with 8086 Microprocessor
5. To make students know about the various day-to-day applications of Microcontroller.

Course Outcomes: The student will be able to:

1. Understand the internal Architecture of both 8086 processor and 8051 microcontroller
2. Write assembly language programs on his own after gaining through knowledge of Instruction set.
3. Know how to establish communication between the processor/controller and peripheral devices.
4. Distinguish well between a Microprocessor and Microcontroller.
5. Write programs in assembly language with ease and co-relate them with high level language programs.

UNIT I

Introduction to Microprocessor and 8086 Microprocessor: Fundamentals of a microprocessor and its evolution, Architecture of 8086 Microprocessor- Segmented memory, Addressing modes, Instruction set, Pin diagram, Minimum and Maximum mode operations.

UNIT -II

Programming using 8086 Microprocessor: Assembly language programming (i.e. machine language programming), Assembler directives, simple programs using Assembler directives, strings, procedures, and Macros Timing.

UNIT -III

Interfacing with 8086 Microprocessor: Memory and I/O interfacing, A/D and D/A interfacing, 8255(PPI), Programmable Internal Timer (8253), Keyboard and display interface 8279, interrupts of 8086.

UNIT IV

Introduction to 8051 Microcontroller and its Programming: 8051 Microcontroller and its Architecture, I/O ports, Instruction set, Assembly language programming, connecting Exte rnal memory.

UNIT V

Interfacing with 8051 Microcontroller, interrupts and special function registers: Interrupts, serial I/O, Timers, Counters, Applications of microcontrollers-Interfacing LEDs, Seven Segment display, Keyboard Interfacing, Induction to PIC Microcontroller.

Text Books:

1. A.K.Ray and K.M.Burchandi, 'Advanced Microprocessors and peripherals' - Tata McGraw Hill Co., 2006
2. Mohammad Ali Mazidi and Janice Gillespie Mazidi"- The 8051 Microcontroller and Embedded Systems"
using assembly and 'c'—prentice hall of India, 2008

Suggested Reading:

1. Douglas. V.Hall- Microprocessors and Interfacing – Tata McGraw Hill- revised edition,2006.
2. Krishna Kant – Microprocessors and Microcontrollers-Architecture, Programming and System Design 8085, 8086, 8051, 8096, Prentice – Hall India- 2007.
3. Kenneth.J. Ayala – "The 8051 Microcontroller Architecture, Programming and Applications" Thomson publishers, 2nd edition.

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With effect from the academic year 2015-2016

EE 324 **DIGITAL SIGNAL PROCESSING**

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To introduce basic concepts of signals and systems and representation of digital system.
2. To discuss DFT, DTFT, FFT, IFFT and Z transformation for the digital system analysis.
3. To make students familiar about design concepts of FIR and IIR filters.
4. To introduce digital signal processor.

Course Outcomes: The student will be able to:

1. Identify the digital system and find its response.
2. Compute and distinguish the DFT, DTFT, FFT and DFS of discrete systems.
3. Compute the Z transforms of discrete systems
4. Design FIR and IIR filter.
5. Be familiar with architecture and features of TMS 320F/2047 DSP.

UNIT-I

Introduction to Digital Signal Processing: 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.

UNIT-II

Fourier Analysis: Distinguishing Fourier transform of discrete singular & discrete Fourier transform, Discrete Fourier series, Phase and amplitude spectra, Properties of Discrete Fourier Transform, Linear Convolution of sequence using DFT, Frequency domain representation of discrete time system DTFT and DFT, Computation of DFT. Fast Fourier transform: Radix-2 decimation in time and decimation in frequency FFT algorithms, Inverse FFT.

UNIT-III

Z- Transform: Application of Z- Transforms for solution of difference equations of digital filters system function, stability criterion, Realization of filters, direct, canonic. Cascade and parallel form, linear phase realization, Introduction to Cosine Transform and Wavelet Transform.

UNIT-IV

IIR Filters: Design of Butterworth Chebyshev filters, IIR. filter design by impulse invariant bilinear transformation, impulse invariance method, step invariance method

UNIT-V

FIR Filters: Characteristics of FIR Digital Filters. Frequency response, comparison of FIR, IIR filters , Window techniques, Design of these filters using Rectangular, Hamming, Bartlet, Kaiser windows, Architecture and features of TMS 320F/2047 and ADSP signal processing chips, Applications of DSP.

Text Books:

1. P. VenkataRamani, M.Bhaskar, "Digital Signal Processo1; Architecture, Programming & Application ", TataMcGrawHill-2004
2. Avatar Singh, S.Srinivasan, "Digital Signal Processing, Thomson Publication, 2004.
3. Lafley," DSP Processing. fundamentals. architecture & features. S.Chand publishers & Co. 2000.
4. Johan G Peoahis, Dimitris G Manolakis, Digital signal processing, 5th eidition, Pearson prentice Hall, 2007

Suggested Reading:

1. Jackson L.B. Digital Filters and Signal Processing. Second edition, Kluwer Academic Publishers , 1989.
2. Oppenheim A V, and Schafer R. W. Digital Signal Processing –Prentice Hall Inc. 1975.
3. Tarun Kumar Rawat Digital Signal Processing first edition Oxford higher education, 2015
4. Anand kumar A, Digital Signal Processing, Second edition PHI learing, 2015.

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EE 325 *POW ER ELECTRONICS LAB*

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:
1. To obtain and plot the characteristics of different static switches.
2. To design the triggering and commutation circuits for SCR.
3. To observe the effect of freewheeling in converters.
4. To familiarize the conversion principle of AC-DC, DC-DC, DC-AC and AC-AC conversion circuits and their applications.
5. To be acquainted with simulation of different power converters.

Course Outcomes: The student will be able to
1. Analyze the effects of control signals on static switches.
2. Distinguish the characteristics of different controlled switches and their applications.
3. Demonstrate the effects of freewheeling.
4. Acquainted with the conversion principles of AC-DC, DC-DC, DC-AC and AC-AC converters
5. Know how to use the simulation software to design different power electronic circuits.

PART-A

1. S.C.R. Characteristics
2. BJT, MOSFET and IGBT Characteristics
3. Gate triggering circuits for SCR using R, RC and UJT.
4. Single phase step down Cycloconverter with Rand RL loads.
5. A.C voltage controllers with R and RL loads.
6. Study of forced commutation techniques.
7. Two quadrant D.C drive.
8. Single phase fully controlled bridge rectifier with Rand RL loads.
9. Single phase half controlled bridge rectifier with Rand RL loads.
10. Buck and Boost choppers.
11. Study of 1 kVA UPS and SMPS for variable voltage with constant load, Constant voltage with variable load.
12. V/f control of AC drive.
13. Single phase inverter with R and RL Loads.

PART-B

1. Simulation of Single phase Full converter and Semi converter.
2. Simulation of Three phase Full converter and Semi converter.
3. Simulation of Single phase Inverter.
4. Simulation of Three phase Inverter.
5. Simulation of Single phase AC voltage controller.
6. Simulation of Single phase Cycloconverter.
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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EE 326 *MICROPROCESSORS & MICROCONTROLLERS LAB*

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:
1. To write and execute simple programs using MASM software tool.
2. To get the students acquainted with the processor kit and improve their Programming skills
3. To make the students work with controller and understand how to program and get the desired output in different platforms.

Course Outcomes: The student will be able to:
1. Have command over basic assembly language programming.
2. Get familiarized with different assembly language software tools.
3. Know how a processor/controller will communi cate with the External world
4. Do some mini projects.
5. understand other advanced Microcontrollers with basics of this basic Microcontroller

List of Experiments

For 8086Microprocessor:

Section 1: Using MASM/TASM (**Any 3 of** the below mentioned Expts. are to be conducted in this Section)
1. Programs for signed/unsigned multiplication and division.
2. Programs for finding average of N 16-bit numbers.
3. Programs for finding the largest number in an array.
4. Programs for code conversion like BCD numbers to 7-Segment.
5. Programs for computing factorial of a positive integer number.

Section 2: Using 8086 Kit(Interfacing) (**Any 2 of** the below mentioned Expts. are to be conducted in this Section)
1. 8255-PPI: Write ALP's to generate triangular, saw-tooth and square waveforms using DAC.
2. 8279-Keyboard Display: Write a small program to display a string of characters.
3. Write an ALP to display some alpha-numeric characters on a seven-segment display module.
4. Traffic Signal Controller.

For 8051 Microcontroller:

Section 3: Using 8051 Kit (**Any 3 of** the below mentioned Expts. are to be conducted in this section)
1. Data Transfer - Block move, Exchange, sorting, Finding largest element in an array.
2. Arithmetic Instructions :Multi byte operations
3. Boolean & Logical Instructions (Bit manipulations)
4. Use of JUMP and CALL instructions.
5. Programs to generate delay and programs using serial port and on chip timer/counter.

Section 4: Program Development using 'c' cross compiler for 8051 (**Any 2 of** the below mentioned Expts. are to be conducted in this section).
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.

Major Equipment required for the LAB:
1. 8086 Microprocessor trainer kit(s) with in-built assembler/disassembler
2. 8051 Microcontroller trainer kit(s)
3. Interfacing Modules for both 8086 and 8051.
4. MASM Software and Kiel/Ride Cross-'c' compiler Software.

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EE 327 *ELECTRICAL MACHINES -II LAB*

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:
1. To understand thoroughly Scott connection
2. To comprehend principles of regulation of alternator
3. To become familiar in operating the induction motor with various speed control methods.
4. To analyze the performance of three phase induction motor
5. To analyze the performance of synchronous motor.

Course Outcomes: The student will be able to:
1. Convert 3 supply to single phase supply
2. Synchronize alternator with grid.
3. Conclude better regulation method of synchronous generator.
4. Control the speed of 3Φ induction motor
5. Compensate reactive power of 3Φ induction motor.

List of Experiments:

1. Three phase to Two-phase conversion (Scott connection).
2. Heat run test on Three-phase transformer.
3. No-load test blocked rotor test and load test on 3-phase Induction motor.
4. Speed control of Three-phase Induction motor by any three of the following.
   a. Cascade connection b. Rotor impedance control c. Pole changing
   d. Rotor slip recovery, Kramer drive e. V/f control.
5. Parallel operation of Alternators.
6. Performance characteristics of Single -phase Induction motor.
7. Voltage regulation of Alternator by
a. Synchronous impedance method b. Ampere -turn method. c. Z.P.F. Method.
8. Regulation of Alternator by slip test.
9. Determination of V curves and inverted V curves of synchronous motor.
10. Power angle characteristics of a synchronous motor.
11. Load characteristics of Induction Generator.
12. P.F Improvement of Induction motor using capacitors.

Note: ATLEAST 10 EXPERIMENTS SHOULD BE CONDUCTED IN THE SEMESTER

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EE 351 **ELECTRICAL ENGINEERING MATERIALS**

(Elective -I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives: After the completion of the course the students should be able to:

1. Analyze the mechanical, magnetic and the electrical properties of materials.
2. Select materials for various engineering application.
3. Establish how failures occur in materials and how to prevent them.

Course Outcomes: The student will be able to

1. Classify the given material based on its properties.
2. Select a proper material for a given application.
3. Experiment on materials in order to test its adaptability
4. Investigate the suitability of material for the latest technological requirement
5. Compare and contrast the characteristics of the materials.

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 magnetic materials, 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 Benergy; Electrical and Electronic engineering materials, PHI, 2014
2. Ian P. Jones; materials science for Electrical and Electronic Engineers, Oxford university press, 2008.
3. R. K Sukhla: Electrical Engineering Materials, MC Graw Hill Education, 2013.

Suggested Readings:

1. Dhir: Electronic components & materials, MC Graw Hill education, 2012.
2. TTTI Mardras: Electrical Engineering materials, MC Graw Hill education, 2014.

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EE 352

OPTIMIZATION TECHNIQUES

(Elective -I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 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.*
3. *To study non linear programming with gradient methods and direct search methods.*
4. *To study dynamic programming.*
5. *To study about Genetic algorithms, particle swarm optimization etc.*

Course Outcomes: The student will be able to :

1. *Acquire the knowledge of obtaining solution for classical optimization problems.*
2. *Acquire the concepts to formulate linear programming problem and get the solution with simplex method, Graphical method, Big-M method etc.*
3. *Acquire the knowledge to solve the nonlinear programming problems with various methods such as gradient methods, direct search methods, Fibonacci method and golden section method.*
4. *Acquire the knowledge to obtain the solution for dynamic programming problems.*
5. *Know the different selection mechanisms in Genetic algorithms, preliminary idea of particle swarm optimization and their application to economic load dispatch.*

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 Pivotal condensation, Graphical method, Simplex algorithm, Big M method,

UNIT III

Non-Linear Programming: One dimensional Search method: Fibonacci method, Golden Section method.
Direct Search method: Uni-variate Search and Pattern Search methods,
Gradient method: Steepest Descent, Conjugate Gradient and Quasi- Newton method,

UNIT IV

Dynamic Programming: Multistage design process, Types, Principle of optimality, Computational procedure in Dynamic programming, Examples using Calculus method and Tabular method of solutions.

UNIT-V

Metaheuristic Techniques :Introduction to Genetic Algorithms, Encoding, Fitness Function, Basic Operators, Section Tournament Selection, Introduction to Particle Swarm Optimization (PSO), variations of PSO, Differential Evolution, Function optimization Formulation, DE fundamentals, Application to Economic load dispatch.

Text Books:

1. S.S.Rao, Engineering Optimization Theory and Applications, New Age International, 3rdEdition, 1998.
2. Jasbir S.Arora, Introduction to Optimum Design, McGraw Hill International Edition,1989.

Suggested Reading:

1. Kalyamoy, Deb, Multi objective optimization using evolutionary algorithms, Wiley publications.
2. S. Rajasekharam, G.A. Vijaya Lakshmi, Neural networks, Fuzzy logic and Genetic algorithms – Synthesis and Applications, PHI publications.

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EE 353 *ADVANCED CONTROL SYSTEMS*

(Elective -I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives: The objective of the course is to:

1. *Understand the method of representing continuous time systems and obtain solution. Transfer function from state model, state-transitions matrix and solution of state equation for discrete systems.*
2. *Understand the concepts of controllability and observability tests for continuous time, Discrete - time and time invariant systems. Also, study SISO system., Pole Placement by state Feedback.*
3. *Understand the importance of response of non-linear systems and construction of phase plane trajectories.*
4. *Understand the procedures to perform stability study using Lyapunov's criteria and construction of Lyapunov function.*
5. *Understand the procedure to formulate the optimal control problem and variational calculus using Hamitonian method.*

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

1. *Represent continuous time systems and obtain solution. Transfer function from state model, solution of state equation and state transition matrix for discrete time systems.*
2. *Follow the concepts of controllability and observability - tests for continuous time, discrete-time and time invariant systems. More importantly can carryout analysis of SOSO system. Pole placement by state feedback.*
3. *Analysis the response of non-linear systems and construction of phase plane trajectories.*
4. *Carryout the stability study through Lyapunov's criteria and construction of Lyapunov function.*
5. *Formulate the optimal control problem and variational calculus using Hamiltonian method.*

UNIT-I

Review of state-space: representation of continuous time systems and their solution, state models for discrete time systems described as difference Equations and transfer functions, Transfer function from State model, State-Transition matrix and solution of state equations for discrete time systems. **UNIT--II**

Controllability and Observability: Concepts of Controllability and Observability, Controllability tests for continuous time, discrete-time, time-invariant systems. Observability tests for continuous time, discrete- time, time-invariant systems. And Controllability and Observability modes in State. Jordan's canonical form, Controllable and Observable companion forms for single input single output Systems, pole placement by State feedback.

UNIT-III

Nonlinear systems: Behavior of Nonlinear systems, jump resonance, Sub-harmonic oscillation, Limit cycles, common physical non-linearities, Singular points, phase plane-method, Construction of phase plane trajectories, Isoclines method, Delta method, Computation of time.

UNIT-IV

Stability: Lyapunov's stability criteria, Theorems, Direct method of Lyapunov For linear systems, Non-Linear Systems, Methods of constructing Lyapunov function, Krasovki's Method, Variable gradient method.

UNIT-V

Optimal Control: Formulation of optimal control problem, calculus of variations, Minimization of functional. Formulation of variational calculus using Hamiltonian method.

Text Books:

1. Gopal.M., Modern Control System Theory, Wiley Eastern Limited, 2004.
2. Schulz D.G., Melsa J.L., State Functions Linear Control Systems, McGraw Hill.

Suggested Readings:

1. M. Gopal, Digital Control and State Variable Methods, Tata Mcgraw Hill, 2/e, 2003.
2. Ogata .K "Discrete Time control Systems", 2nd Edition, PHI publications, 1995

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EE 354 *RENEWABLE ENERGY SYSTEMS*

(Elective-1)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives: The objective of the course is to:

1. *Understand procedures and importance of Energy Planning, co-generation, Alternative energy sources, Energy Scenario in India in terms of percentage of different sources of energy.*
2. *Understand the importance Non-convential energy sources such as wind and solar in the context of power generation from these sources and plans of power sector as well as thrust given.*
3. *Understand the technical parameter of PV systems - stand alone as grid connected schemes also its advantages and limitations.*
4. *Understand the technical parameter of solar thermal energy systems, solar cooking systems as heating systems covering its maintenance.*
5. *Understand the importance of importance of wind energy in the context of power shortage and to identify possible location for installation, design aspects of wind turbine systems and energy derived from wind turbine.*

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

1. *Acquire knowledge required for Energy planning, importance of co-generation. Alternative energy sources and Energy scenario in India indicates in terms percentage of different sources of energy.*
2. *Significance and importance of non-convential energy source such as wind and solar in the context to generate more power from reviewable energy sources and the thrust the India power sector is giving.*
3. *Importance of solar PV systems – stand alone and grid connected scheme. Also advantages and limitations of solar PV technology.*
4. *Importance solar thermal energy systems. Solar cooking system and solar heating systems including maintenance aspect.*
5. *Importance of wind energy in the context of power shortage in Indian power sector, design aspects of wind turbine systems and energy designed for wind turbine – wind power generation installations.*

UNIT-I

Basics of Energy: Energy and Power, Estimation of Energy Bill, Characteristics of energy, Energy parameters, Energy planning, cogeneration, classification of energy, Energy Resources, Alternative energy sources, Energy scenario in Indian context.

UNIT-II

Introduction to Energy Sources :Significance of non-conventional energy sources, solar energy, wind energy, energy from biomass and biogas, ocean energy, wave energy, Tidal energy, Geo thermal energy, fuel cell, MHD.

UNIT-III

Solar photovoltaic technologies: Solar spectrum, extraterrestrial radiation, solar radiation at a given location, Advantages and limitations of solar PV technology, PV Technology, Basics of Technology, The amount of power generated, the rated power and actual power from a module, Generating more power using solar PV, Generating more power using solar PV – Protection of solar cells., Solar PV systems and their components, Solar PV lantern, Stand – alone PV systems, Home lighting and other usage, solar PV water pumping system.

UNIT-IV

Solar thermal technologies: Solar Thermal Energy Systems, Absorption and Radiation, Solar Cooking systems, Principle of Cooking, Cooking by Boiling, speed of cooking, Types of Solar Cooker, Solar Distillation System, Operation of Solar Distillation, Solar Heating Systems (Hot water), Principle of Conversion, Applications, Types of Heating systems, design and costing of solar heating systems., Maintenance.

UNIT-V

W ind Energy: Wind Flow, Motion of wind, vertical wind speed variation, distribution of wind speeds, Power in the wind, conversion of wind power- wind turbine, Worldwide wind

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Installations, Wind Turbine Sizing and systems design , energy derived from a wind turbine, annual energy production- approximate and accurate, estimation of required wind turbine power rating.

Text Books:

1. Chetan singh solanki: Renewable Energy Technology, PHI, 2009 A practical guide for begineers.
2. B H Khan: Non conventional Enginery & Resources, MC Graw Hill education, 2012.
3. Er. R.K.Rajput: Non-Conventional Energy Sources and Utilization, S.Chand Publishing, 2014.

Suggested Readings:

1. Garg & prakash: Solar Energy" Fundamentals & Applications, MC Graw Hill education 2012.
2. DP Kothari: Singal & Ranjan Renewable Energy Sources & Emerging Technologies, PHI 2014.
3. G.S.Sawhney: Non-Conventional Energy Resources, PHI learning pvt ltd., edition 2012.

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EE 328 *MINI PROJECTS*

Instruction	21 Periods
Duration of University Examination	3 Hours
University Examination	0 Marks
Sessional	25 Marks
Credits	1

Course Objectives: The objective of the course is to:

1. *Understand the methods to carryout mini project in the area pertaining to Electrical and Electronics Engineering.*
2. *Understand the procedures/ methods to formulate the project scope of work and collect required literature.*
3. *Familiarizing the way to problem formulation and identify suitable techniques to solve.*
4. *Summarize the results and draw the conclusions.*
5. *To get exposure in report writing and discuss the application aspect of the project.*

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

1. *Identify scope to carryout mini project in the area pertaining to Electrical and Electronics Engineering.*
2. *Formulate project scope and collect required information as literature survey.*
3. *Formulate problem to apply suitable techniques to solve.*
4. *Discuss the results and draw the conclusions*
5. *Discuss the aspect of suitable applications and also get exposure in report writing.*

Mini Project is a course that a student has to undergo during his/her academic term, which involves the student to explore in a discipline that belongs to their research interest within their program area. It is a credit based course. The Mini Project shall be carried out during 6 th semester along with other lab courses by having regular weekly slots. Students will take mini project batch wise and the batches will be divi ded as per the guidelines. The topic of mini project should be so selected enabling the students to complete the work in the stipulated time with the available resources in the respective laboratories. The scope of the mini project could be handling part of the consultancy work, maintenance of the existing equipment, development of new experiment setup or can be a prelude to the main project with a specific outcome.

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EE 329 *INDUSTRY VISIT*

Least 3 days in semester	3 x 8 =24 hours
Sessional /Examination	*Grade

Course Objectives: The objective of the course is to:

1. *Physically see the process of manufacturing procedure and steps involved.*
2. *Collect the information in respect of materials, sources of supply.*
3. *Understand the sequential stages involved in manufacturing process.*
4. *Understand the procedure to write the 'industry visit' technical report by compiling all the information collected during the visit.*
5. *Understand the safety procedures and pre-cautions followed in Industry, confidentiality of the process and the man power required.*

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

1. *Know the importance of visiting an engineering industry from the point of view of process of manufactory procedures and set-up.*
2. *Summarize the required information with regard to materials, source of supply in respect of a product.*
3. *Know the stages in manufactory of a product*
4. *Prepare the 'industry visit' technical report covering the details of visit and it importance.*
5. *Visualize the safety precautions to be follow in industry, confidentiality of the product processing as the man power required.*

Students are expected to visit at least two industries during the semester and submi t a detailed technical report on the study -visits to the Department. The Department should evaluate the reports through a Committee consisting of Head of the Department and two more faculty members to award the Grades *.

*Excellent /Very Good/Good /Satisfactory /Unsatisfactory.

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Dept. of ELECTRICAL & ELECTRONICS ENGINEERING

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

B.E. 4th YEAR SYLLABUS

For the Academic Year 2016-17

June 2016

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Semester- I

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SCHEME OF INSTRUCTION AND EXAMINATION
4/4 B.E.
ELECTRICAL & ELECTRONICS ENGINEERING

I- SEMESTER

S.No	Code	Subject	Scheme of Instruction			Scheme of Examination			
			Periods per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		End Exam	Sessionals	
1	EE 411	Power System Operation & Control	4	-	-	3	75	25	3
2	EE 412	Power Semiconductor Drives	4	-	-	3	75	25	3
3	EE 413	HVDC & FACTS	4		-	3	75	25	3
4	MB214	Managerial Economics & Accountancy	4			3	75	25	3
5		Elective –II	4	-	-	3	75	25	3
6	EE 414	Digital Signal Processing Lab	-	-	3	3	50	25	2
7	EE 415	Power Systems Lab	-	-	3	3	50	25	2
8	EE 416	Project Seminar	-	-	3	3	-	25	1
		TOTAL	**20**	**-**	**9**	**24**	**475**	**200**	**20**

L: Lecture, T: Tutorial, P: Practical

S.No	CODE	ELECTIVE-II
1	EE 461	Electrical Machine Design
2	EE 462	Artificial Intelligence Techniques in Electrical Engineering
3	EE 463	Principles of Embedded Systems
4	EE 464	Basic VLSI Design
5	EG 451	Technical Writing & Presentation Skills
6	ME 464	Entrepreneurship

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EE 411 **POWER SYSTEM OPERATION AND CONTROL**

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. *Understand the formulation of Load-Flow problems applying different methods and carryout load-flow studies and compare.*
2. *Understand the importance of Economic Operation of Power Systems including losses*
3. *Understand the importance of Load Frequency Control in the operation of power systems.*
4. *Understand the basic definitions of and classification of power system stability, stability analysis of Single Machine Connected to Infinite Bus (SMIB) system, and voltage stability analysis.*
5. *Understand the importance of reactive power and FACTS devices for stable operation of Power systems.*

Course Outcomes: After completion of the course, the student 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, Bmm Coefficients, Economic operation including transmission losses.

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.

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Text Books:

1. *I. J. Nagrath and D.P. Kothari, 'Modern Power System Analysis',4th Edition TMH Publication,2011*
2. *CL Wadhwa, 'Electrical Power Systems', 3rd Edition, New Age International Publications, 2014*
3. *O. Elgard, 'Electric Energy Systems Theory', 2nd Edition. TMH Publication,2001*

Suggested Reading:

1. *A. Chakrabarthy and S. Halder, 'Power System Analysis Operation and control', 3rd Edition PHI Publications, 2010*
2. *D. Das, 'Electrical Power System' 1st Edition, New Age International Publications, 2010.*
3. *S. Sivanagaraju, and G. Srinivas, 'Power system, Operation and Control', Pearson publications.2010*

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EE 412 POWER SEMICONDUCTOR DRIVES

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. *Understand the fundamental torque, speed, conventions for a given drive.*
2. *Comprehend D.C drive concepts and applications.*
3. *Assimilate the concepts and applications of A.C drives.*
4. *Know the suitability of a particular drive for a given application.*

Course Outcomes: The student will be able to

1. *Select a particular drive for a given application.*
2. *Design a proper controller for a D.C motor drive with the given detailed specifications.*
3. *Acquire knowledge in various speed control techniques of induction motor drives.*
4. *Acquire knowledge in various speed control techniques of synchronous motor drives.*
5. *Identify the adaptability of a particular drive (synchronous motor, BLDC, stepper motors and SRM) for given load requirements.*

UNIT- I: Electrical Drives

Introduction: Advantages of Electrical Drives, Parts of Electrical Drives, Choice of Electrical Drives.
Dynamics of Electrical Drives: Fundamental Torque Equations, Speed Torque Conventions and Multi-quadrant Operation, Equivalent Values of Drives Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy, Loss in Transient Operations, Steady State Stability, Load Equalization.
Selection of Motor Power Rating: Thermal Model of Motor for Heating and Cooling, Classes of Motor Duty, Determination of Motor Rating.

UNIT- II: DC Motor Drives

DC Motors and Their Performance, Starting, Braking, Controlled Rectifier Fed dc Drives, Single-Phase Fully-Controlled Rectifier Control of dc Separately Excited Motor, Single- Phase Half-Controlled Rectifier Control of dc Separately Excited Motor, Three- Phase Fully-Controlled Rectifier Control of dc Separately Excited Motor, Three-Phase Half-Controlled Rectifier Control of dc Separately Excited Motor, Multi-quadrant Operation of dc separately Excited Motor Fed from Fully-controlled Rectifier, Supply Harmonics, Power Factor and Ripple in Motor Current, Chopper Controlled dc Drivers, Chopper control of separately Excited dc motors, Chopper control of series motor, Source current harmonics in Choppers, Converter ratings and closed-loop control.

UNIT- III: Induction Motor Drives

Soft start using saturable reactor starter, unbalanced starting scheme for soft start, Part winding starting.
Braking: Regenerative braking, Plugging or reverse voltage braking, Dynamic (or rheostatic) braking, Transient Analysis, Stator Voltage Control, variable Frequency control from Voltage sources, Voltage Source Inverter (VSI) Control, Cycloconverter control, Closed loop speed control and converter Rating for VSI and Cycloconverter, Induction Motor Drives, Variable Frequency Control from a Current Source, Rotor Resistance control, Slip Power Recovery, Static Kramer drive , Static Scherbius

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drive, Variable Speed constant Frequency Generation, Single- phase Induction Motors, Braking of single-phase induction motors, Speed control of single-phase induction motors.

UNIT- IV: Synchronous Motor Drives
Operations from Fixed Frequency Supply, Synchronous Motor variable speed drives, Variable frequency control of Multiple Synchronous Motors, Self–controlled Synchronous Motor Drive Employing Load Commutated Thyristor Inverter, Starting Large Synchronous Machines, Self-controlled Synchronous Motor Drive Employing a Cyclo-converter, Permanent Magnet ac Motor Drives, Brushless dc Drives.

UNIT- V: Special machines & Drives
Linear Induction Motor and its control, Stepper(or Stepping) Motors, Variable reluctance, permanent magnet, Important features of stepper motors, Torque versus stepping(or pulsing) rate characteristics, Drive circuits for stepper motors, Switched (or variable) Reluctance Motor, Operation and control requirements, Converter circuits, Modes of operation.

Text Books:

1. G.K.Dubey, 'Fundamentals of Electric Drives', *2nd Edition* Narosa Publishing House, 2016
2. S.K.Pillai, 'A course in Electric Drives', *3rd Edition* New Age International, 2015

Suggested Reading:

1. Vedam Subrahmanyam, 'Electric Drives-Concepts and Applications', *2nd Edition* TMH, 2010
2. N.K.De and P.K. Sen, 'Electrical Drives', 1st Edition, PHI, 2006.

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EE 413 **HVDC & FACTS**

Instruction	4 Periods / Week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. *Understand operating principles of HVDC systems and control aspects.*
2. *Understand the difference between AC and DC transmission and analysis the HVDC converter*
3. *Understand the concepts of HVDC system control and analyse the power flow in DC systems*
4. Understand and identify the problems and constraints with stability of large interconnected system.
5. Understand the concepts of shunt and series controllers

Course Outcomes: The student will be able to

1. *Acquire the knowledge to compare AC and HVDC systems in terms of power transmission and stability.*
2. *Will be able to compare AC and DC transmission systems and analyse the HVDC converter circuit*
3. *Will be able to acquire the knowledge about HVDC system control methods and power flow in DC systems*
4. Classify various types of FACTS devices/ controllers and *Identify and select the suitable FACTS device for specific application*
5. Acquire the knowledge of about shunt and series FACTS controllers and modelling aspects
6. *Acquire knowledge in improving the stability of the power system by applying FACTS controllers.*

UNIT-I: Comparison of AC and DC Transmission System
Applications of DC Transmission, Types of DC links, Analysis of HVDC Converters, Pulse number, analysis with and without overlap, Equivalent circuit of Rectifier and Inverter, Converter bridge characteristics.

UNIT-II: HVDC System Control
Principles of dc link control, Starting and stopping of dc link, Power control, Harmonics & filters, Introduction and generation of harmonics, Types of ac filters, Power flow analysis in ac/dc systems, General modeling of dc links, Solutions of ac- dc power flow.

UNIT-III: Flexible AC Transmission Systems (FACTS)
Concept of FACTS, Flow of power in an AC system, Dynamic stability consideration, Basic types of FACTS controllers.

UNIT-IV: Static Shunt Compensators
SVC & STATCOM, Objectives of shunt compensation, Methods of controllable VAr generation, Switching converter type VAr generators, Basic operating principle and control approaches.

UNIT-V: Static Series Compensators
GCSC, TSSC, TCSC & SSSC, Objectives of series compensator, Variable impedance type series compensators, Basic operating control schemes, Power angle characteristics, Control range and VA rating, External control, Combined compensators.

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Text Books:

1. K.R. Padiyar, 'HVDC Power Transmission System', 3rd Edition, New Age International, 2015.
2. N.G. Hingorani and L.Gyugyi: 'Understanding FACTS', Wiley IEEE Press, 2000

Suggested Reading:

1. Arrillaga J., '*High Voltage Direct Current Transmission', 2nd Edition, the Institution of Electrical Engineers,* London, 1998.

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MB 214 MANAGERIAL ECONOMICS AND ACCOUNTANCY

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives: TheObjectives of the course are:
1. To introduce managerial economics and demonstrate its importance in managerial decision making.
2. To develop an understanding of demand and relevance of it's forecasting in the business.
3. To provide the basics of market structure and the concept of equilibrium in different market structures.
4. To examine the economic analysis of production process, types of inputs and to explain different costs and their relationship with the output.
5. To understand the importance of project evaluation in achieving a firm's objective.
6. To explain the concept of Accountancy and provided knowledge on preparation & analysis of Final accounts.

Course Outcomes: After completion of the course, student will be able to:
1. To apply fundamental knowledge of Managerial economics' concepts and tools
2. To understand various aspects of demand analysis and forecasting
3. To understand price determination for different markets
4. To study production theory and analyze various costs & benefits involved in it so as to make best use of resources available.
5. Helps to analyze different opportunities and come out with best feasible capital investment decisions
6. Allow students to study in detail about accountancy concepts and conventions, Final accounts and financial analysis

UNIT-I: Introduction to Managerial Economics

Introduction to Economics and its evolution - Managerial Economics -its scope, importance and its usefulness to engineers-Basic concepts of Managerial economics.

UNIT-II: Demands Analysis

DemandsAnalysis-Conceptofdemand,determinants,Lawofdemand,itsassumptions, Elasticity of demand, price, income and cross elasticity, Demand Forecasting - Markets Competitive structures, price-output determination under perfect competition and Monopoly. (Theory questions and small numerical problems can be asked).

UNIT-III: Production and Cost Analysis

TheoryofProduction-FirmandIndustry-Productionfunction-input-outrelations- law sofreturns-internal and external economies of scale. Cost Analysis: Cost concepts- fixedandvariablecosts-explicitandimplicitcosts-outofpocketcostsandimputed costs - Opportunity cost - Cost output relationship - Break-even analysis. (Theory and problems).

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UNIT-IV: Capital Management

Capital Management, its significance, determinants and estimation of fixed and working capital requirements, sources of capital - Introduction to capital budgeting, methods of payback and discounted cash flow method switch problems.

(Theoryquestionsarenumericalproblemsonestimatingworkingcapitalrequirements and evaluation of capital budgeting opportunities can be asked).

UNIT-V: Accountancy

Book-keeping, principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments.

(Theory questions and numerical problems on preparation of final accounts, cashbook, petty cash book, bank reconciliation statement).

Text Books

1. MehtaP.L., 'Managerial Economics–Analysis, Problems and Cases', Sulthan Chand & Son's Educational publishers, 2011.

2. Maheswari S.N. 'Introduction to Accountancy', Vikas Publishing House, 2005.

3. PandayI.M. 'FinancialManagement', VikasPublishing House, 2009.

Suggested Readings:

1. Varshney and KL Maheswari, 'Managerial Economics', Sultan Chand, 2001.
2. M. Kasi Reddy and S.Saraswathi, 'Managerial Economics and Financial Accounting', Prentice Hall of India Pvt Ltd, 2007.
2. J C Pappas and E F Brigham, 'Managerial Economics',

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EE 461 ELECTRICAL MACHINE DESIGN (Elective-II)

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. *To understand the nature of various Electrical Engineering Materials.*
2. *To understand the Specifications of various A.C. and D.C. machines.*
3. *To know the importance of magnetic and thermal circuit calculations in the design aspect.*
4. *To know the various design features of Electrical machines.*

Course Outcomes: The student will be able to

1. *Select a suitable material for a given application.*
2. *Identify the need and required pre-requisites for machine design*
3. *Distinguish the appropriate design procedure for a given DC/AC machine*
4. *Determine the main dimensions of a given DC/AC machine.*
5. *Design a proper cooling system for a given machine*

UNIT -I: Basic Considerations in Machine Design

Principles of Design: Introduction-Types of Electrical Machines, Specifications, Limitations in Design-O/P Co-efficient, Importance of specific loadings-effects of materials on design, General design procedure.

Electrical Materials: Conducting Materials and their properties, Classification, Applications Insulating Materials and their properties, Classification, Applications, Magnetic Materials and their properties, Classification, Applications.

UNIT-II: Design of Magnetic circuit and Thermal Circuit.

Magnetic Circuit Design: Magnetic circuits of Electrical machines. Laws of magnetic circuits. Ampere turns for magnetic circuit. Calculation of Magnetic circuit of D.C.Machine and Induction Motor.

Thermal circuit Design: Temperature rise in Electrical machines-Standard ratings of electrical machines-Modes of heat dissipated-Quantity of Cooling Medium required.

UNIT-III: Design of DC Machines

Important features of DC Machines, Output equation. Selection of Specific magnetic and electrical loadings-factors effecting selection of no. of poles-Selection of core length and Diameter, Calculation of length of air gap. Design of shunt field system. Design of armature winding only.

UNIT-IV: Design of Transformers

Introduction. Output Equation (both 1φ & 3φ), E.M.F./turn, Different dimensions of Transformer, Steps to design a Transformer, Design of Main dimensions of Transformer Tank.

UNIT-V: Design of AC Rotating Machines

Design of 3φ Induction Motor: Introduction-O/P Equation-Estimation of main Dimensions, air gap length of Induction Motor.

Design of 3φ Alternators: Introduction-O/P Equation, Estimation of main dimensions, length of air gap, Estimation of turns /phase, Design of tooth and slot.

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Text Books:

1 K.G.Upadhyay,'Design of Electrical Machines', New Age Intl. Publishers, NewDelhi,2013.
2 Dr. V.N.Mittle and A.Mittal,'Design of Electrical Machines',5th Reprint Edition, Standard Publishers Distributors, New Delhi,2013.

Suggested Reading :

1. A.K.Sawhney,'A Course in Electrical Machine Design', 6th Edition, Dhanpat Rai & Co, Pvt Ltd, New Delhi, 2014.
2. R.K.Agarwal, 'Principles of Electrical Machine Design',5th Edition, S.K.Kataria & Sons, Delhi, 2014.
3. M.G.Say, 'The Performance and Design of Alternating Current Machines',3rd Edition, CBS Publishers & Distributors, New Delhi ,2002

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EE 462 AI TECHNIQUES IN ELECTRICAL ENGINEERING (Elective-II)

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *To understand basics of ANN and FUZZY Logic.*
2. *To understand basics of advanced optimization algorithms such as Genetic algorithms.*
3. *To understand the techniques to apply to power system problems such as Economic load dispatch, load frequency control, Reactive power control etc.*

Course Outcomes: After completion of the course, the student will be able to:

1. *Acquire knowledge of Different ANN algorithms.*
2. *Acquire knowledge of membership function fuzzification and Defuzzification*
3. *Understand different selection mechanisms in genetic algorithm.*
4. *Apply AI techniques in Electrical Engineering applications such as Economic load dispatches and reactive power control etc.*
5. *Apply AI techniques for speed control of ac & dc motors.*

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, Competitive learning, Boltzman learning, Supervised learning, Unsupervised learning, Reinforcement 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.

UNIT – III: Fuzzy Logic

Introduction, Fuzzy versus crisp, Fuzzy sets, Membership function, Basic Fuzzy set operations, Properties of Fuzzy sets, Fuzzy cartesion Product, Operations on Fuzzy relations, Fuzzy logic, Fuzzy Quantifiers, Fuzzy Inference, Fuzzy Rule based system, Defuzzification methods.

UNIT – IV: Genetic Algorithms

Introduction, Encoding, Fitness Function, Reproduction operators, Genetic Modeling, Genetic operators, Crossover, Single, site crossover, Two point crossover, Multi point crossover, Uniform crossover, Matrix crossover, Crossover Rate, Inversion & Deletion, Mutation operator, Mutation, Mutation Rate, Bit, wise operators, Generational cycle, convergence of Genetic Algorithm.

UNIT–V: Applications of AI Techniques

Economic load dispatch, Load frequency control, Single area system and two area system, Reactive power control, speed control of DC and AC Motors.

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Text Books:

1. S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms"- PHI, New Delhi, 2010.
2. D.E.Goldberg," Genetic Algorithms", 4th Impression, Pearson Education Inc., 2009.
3. IEEE Journals.

Suggested Reading:

1. P.D.Wasserman,Van Nostrand Reinhold,"Neural Computing Theory & Practice", New York,1989.
2. Bart Kosko,"Neural Network & Fuzzy System" Prentice Hall, 1992.
3. Kalyanmoy Deb, "Multi objective optimization using evolutionary algorithms", Wiley Publications, 2013.

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EE 463 PRINCIPLES OF EMBEDDED SYSTEMS (Elective-II)

Instruction	4 Periods per week -
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *To understand the basic structure of 8051 Microcontroller.*
2. *To understand the concepts of 8051programming*
3. *To understand the concept of Real time operating systems.*
4. *To have a basic idea of advanced embedded processors*
5. *To understand a basic embedded architecture*

Course Outcomes: student will be able to:

1. *Acquire the knowledge on elements of microcontroller*
2. *Have knowledge on programming using 8051 microcontroller*
3. *Have basic knowledge on real time operations of system.*
4. *Have basic knowledge on advanced embedded processors*
5. *have basic knowledge on embedded programming*

UNIT-I: Embedded Computing

Introduction, Complex Systems and Microprocessor, Embedded System Design Process, Formalisms for System Design, Design Examples, 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: Basic Assembly Language Programming Concepts

Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051, Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic, Jump and Call Instructions, Further Details on Interrupts.

UNIT-III: Applications

Interfacing with Keyboards, Displays, D/A and NO Conversions, Multiple Interrupts, Serial Data Communication, Introduction to 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.

UNIT-IV: Basic Design Using a Real-Time Operating System

Principles, Semaphores and Queues, Hard Real-Time ,Scheduling Considerations, Saving Memory and Power, An example RTOS like uC-OS (Open Source).

Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System, Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

UNIT- V: Introduction to advanced architectures

ARM and SHARC, Processor And memory organization and Instruction level parallelism, Net advanced embedded systems: Bus protocols, 12C bus and CAN bus, Internet- Enabled Systems, Design Example-Elevator Controller.

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Text Book:

1. Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Morgan Kaufmann Publisher, 2006.

Suggested Reading:

1. David E-Simon, "An Embedded Software Primer", Pearson Education, 2007.
2. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dreamtech Press, 2005.
3. Tim Wilmshurst, "An Introduction to the Design of Small Scale Embedded Systems", Pal Grave Publisher, 2004.
4. Sriram V Iyer, and Pankaj Gupta, "Embedded Real Time Systems Programming", Tata McGraw Hill, 2004.
5. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.

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EE 464 BASIC VLSI DESIGN (ELECTIVE-II)

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 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 Bi-CMOs.*
4. *To Learn the bi-polar circuit designs*
5. *To learn HDL Programming.*

Course Outcomes: student will be able to:

1. *To design logic circuits using pMOS and nMOS technologies*
2. *To design cMOS and Bi-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 CMOS 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 – Types of rules- SCMOS Design Rule set II.

UNIT III: CMOS LOGIC GATES & OTHER COMPLEX GATES

Gate delays – Logical Effort - CMOS Static Logic – Transmission Gate Logic – Tri-State Logic – Pass Transistor Logic – Dynamic CMOS Logic – Domino CMOS Logic, NORA CMOS Logic, Differential Cascade Voltage Switch (DCVS) Logic, True Single Phase Clock (TSPC) Dynamic Logic.

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: Array – Braun array – Baugh-Wooley Array. Introduction to FPGA – Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures.

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Text Books:

1. Douglas A. Pucknell and 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 and Ken Martin, "Analog Integrated Circuit Design", John Wiley & Sons, 2004.
2. Neil. H.E. Weste and Kamran Eshraghian," principles of CMOS VLSI Design: 'A systems perspective', 2nd Edition, Pearson Education, 2004.

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EG 451 TECHNICAL WRITING & PRESENTATION SKILLS

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives: Students must be able to:

1. *Understand communication as a process and channels of it in general 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. *Learnt to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.*

Course Outcomes:

1. *Students will communicate effectively, without barriers*
2. *Students will write error free sentences using technology specific words*
3. *Students will correspond effectively*
4. *Students will draft technical reports, proposals and articles.*
5. *Students will make effective technical presentations*

Unit I: Communication

Channels of Communication: Nature and process. – 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.

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Unit V: 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.

References:

1.M Ashraf Rizvi, **"**Effective Technical Communication**",** Tata McGraw Hill Education Pvt Ltd, 2012.
2.KavitaTyagi and Padma Misra, **"**Basic Technical Communication**",** PHI Learning Pvt Ltd, 2012.
3.Meenakshi Raman &Sangeeta Sharma, **"**Technical Communications-Principles and Practice**",** Oxford Semester Press, Second Edition, 2012.
4.Sharon J Gerson and Steven M Gerson**,** **"**Technical Writing**"** Pearson Education Inc., 2013.
5. Edgar Thorpe and Showick Thorpe**,"** Objective English**",** Pearson Education, 2nd Edition, New Delhi, 2007.
6.R.C Sharma and Krishna Mohan, **"**Business Correspondence and Report Writing**",** Tata McGraw Hill, 2003
7.Prakash P**,'**Verbal and Non-Verbal Reasoning**',** Macmillan India Ltd., 2nd Edition, New Delhi, 2004.

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ME 464

Entrepreneurship (Elective – II)
(for Mech, Prod, Civil, EEE & CSE)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Course Objectives:

1. *To understand the essence of Entrepreneurship*
2. *To know the environment of industry and related opportunities and challenges*
3. *To know the concept a procedure of idea generation*
4. *To understand the elements of business plan and its procedure*
5. *To understand project management and its techniques*
6. *To know behavioral issues and Time management*

Course Outcomes: After completing this course, students will be able to:

1. *Apply the entrepreneurial process*
2. *Analyze the feasibility of a new business plan and preparation of Business plan*
3. *Evaluate entrepreneurial tendency and attitude*
4. *Brainstorm ideas for new and innovative products or services*
5. *Use project management techniques like PERT and CPM*
6. *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

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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", Tata Me Graw Hill Publishing Company Ltd., 5lh Ed., 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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EE 414 **DIGITAL SIGNAL PROCESSING LAB**

Instruction	3 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. *To understand fundamental concepts of Digital signal processing*
2. *To learn applications of various signal processing techniques using MATLAB*
3. *To learn to analyze signal using DSP*
4. *To learn to synthesize signal using DSP*
5. *To acquire knowledge on digital control of electrical appliances*

Course Outcomes: Students will be able to

1. *Simulate various signal transformations using MATLAB*
2. *Design filters using window techniques*
3. *Control AC machines using DSP*
4. *Control DC machines using DSP*
5. *To simulate control signals using MATLAB*

List of Experiments:

PART-A

1. Waveform generation -Square, Triangular and Trapezoidal.
2. Verification of Convolution Theorem-comparison Circular and Linear Convolutions.
3. Computation of DFT,IDFT using Direct and FFT methods.
4. Verification of Sampling Theorem
5. Design of Butterworth LP & HP filters.
6. Design of Chebyshev LP & HP filters
7. Design of FIR and IIR filters.
8. 16 bit Addition, Integer and fractional multiplication on 2407 DSP Trainer kit.
9. Generation of sine wave and square wave using DSP trainer kit.
10. Response of Low pass and High pass filters using DSP trainer kit.
11. Linear convolution using DSP trainer kit.
12. PWM Generation on DSP trainer kit.
13. Key pad interfacing with DSP.
14. LED interfacing with DSP.

PART-B

1. Stepper Motor Control using DSP.
2. DC Motor 4 - quadrant speed control using DSP.
3. Three phase IM speed control using DSP.
4. Brushless DC Motor Control.

Note: Any **EIGHT** experiments from **PART-A** and **TWO** from **PART-B** should be conducted in the semester.

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EE 415 POWER SYSTEMS LAB

Instruction	3 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. *To determine regulation & efficiency of short, medium and long transmission lines and to calculate A, B, C, D constants.*
2. *To understand the importance of protective relays in power system such as different protection of transformer DMT Characteristics of over current relay, Buchholz relay and static relays.*
3. *To understand the procedure to determine sequence parameters of transformer and alternator.*

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

1. *Determine ABCD constants of transmission lines and evaluate regulation, efficiency.*
2. *Acquire knowledge in relay setting for safe operating of power system.*
3. *Determine sequence parameters of transformer and alternator and draw its importance.*
4. *Determine the time constant of an alternator.*
5. *Determine the dielectric strength of oil and calculate the efficiency of string insulators.*

List of Experiments:

1. Determination of regulation & efficiency of Short, Medium and Long transmission lines.
2. IDMT characteristics of Over-current relay.
3. Determination of A, B, C, D constants of Short, Medium, Long lines & circle diagrams.
4. Differential protection of transformer.
5. Sequence impedance of 3-Phase Alternators.
6. Determination of positive, negative and zero-sequence reactance of 3 -Phase transformers using sequence current excitation fault calculation.
7. Synchronous machine reactance and time constant from 3-Phase S.C test.
8. Characteristics of Static relays.
9. Static excitation of Synchronous Generator.
10. Determination of dielectric strength of oil & Study of Buchholz relay.
11. Parallel operation of Alternators.
12. Measurement of capacitance of 3-core cables.
13. Fault location of Underground cables.
14. Simulation of string of insulators for determination of Voltage distribution and String efficiency.

At least **TEN** experiments should be completed in the semester.

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EE 416 **PROJECT SEMINAR**

Instruction	3 Periods per week
Sessionals	25 Marks
Credits	1

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

1. *Develop the skills of analyzing a problem, solving it by different approaches, building interactions with the other organizations.*
2. *Develop the skills of presenting a concept, independent learning and addressing the societal issues, economical outlay.*
3. *Acquire knowledge in conducting systematic literature survey and preparing the summary on the chosen topic.*
4. *Acquire knowledge in preparing the notes for presentation which exhibit the level of understands on the subject and further improvement.*
5. *Acquire knowledge in prepare project report, which will help in preparing such report while taking up the jobs/ project works.*

Dealing with a real time problem should be the focus of under graduate project. Faculty members should prepare project briefs (giving scope and references) well in advance, which should be made available to the students in the department. The project may be classified as hardware / software modeling / simulation. It may comprise any or all elements such as analysis, design and synthesis.

The department should appoint a project coordinator who will coordinate the following.

- Grouping of students (a maximum of 3 in group)
- Allotment of projects and project guides
- Project monitoring at regular intervals.

All project allotment is to be completed by the 3rd week of IV–Year, I-Semester, so that the students get sufficient time for completion of the project by the end of II-semester. Efforts be made the some of the projects are carried out in reputed industries / research organizations with the help of industry coordinators. Problems can also be invited from the industries to be worked out through undergraduate projects. Oral presentation is an important aspect of engineering education. The students have to deliver a seminar on the 'Project' they have chosen or allotted by the department, on the advice and approval from the faculty members. Students are exposed to the following aspects for seminar presentation.

- Literature Survey
- Organization of the material
- Power point presentation
- Technical writing

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Each student project batch is required to:

1. Submit a one-page synopsis before the seminar talk for display on the notice board.
2. Give a 20-30 minutes presentation through power point presentation.
3. Submit a report on the project with list of references and slides used.

Project Seminars are to be scheduled from the 4th week of the I-semester to the last week of the I-semester.
For award of Sessional marks students are judged by the project coordinator and guide on the basis of an oral and written presentation as well as their involvement in the discussions.

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Semester- II

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SCHEME OF INSTRUCTION AND EXAMINATION
4/4 B.E.
ELECTRICAL & ELECTRONICS ENGINEERING

II- SEMESTER

S.No	Code	Subject	L	T	P	Scheme of Examination			
						Duration in Hours	Maximum Marks		Credits
							Univ. Exam	Sessionals	
1	EE 421	Utilization of Electrical Energy	4	-	-	3	75	25	3
2	ME419	Industrial Administration & Financial Management	4	-	-	3	75	25	3
3	-	Elective –III	4		-	3	75	25	3
4	-	Open Elective/ Elective –IV	4	-	-	3	75	25	3
5	EE 422	Electrical Simulation Lab	-	-	3	3	50	25	2
6	EE 423	General Seminar	-	-	3	-	-	25	1
7	EE 901	Project	-	-	6	viva	100	50	9
		TOTAL	**16**	**-**	**12**	**15**	**450**	**200**	**24**

S.No	CODE	ELECTIVE-III
1	EE 471	High Voltage Engineering
2	EE 472	Computer Methods in Power System
3	EE 473	Power System Operation & Deregulation
4	EE 474	Power Quality Engineering
5	EE 475	Electrical Distribution Systems
6	EE 476	Power System Reliability

S.No	CODE	ELECTIVE-IV
1	EE 481	Electronic Instrumentation
2	ME 472	Intellectual Property Rights
3	EC 475	Digital Image Processing
4	CE 422	Disaster Mitigation & Management
5	IT 429	Open Elective from other departments (Internet of things)
6	IT 428	Open Elective from other departments (Network Security)

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EE 421 **UTILIZATION OF ELECTRICAL ENERGY**

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 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: Students will able to

1. *Distinguish the adaptability of heating and welding concepts for a given application*
2. *Identify the necessity of illumination for specified requirement*
3. *Select proper traction system and its corresponding drive for industrial applications*
4. *Select the proper furnace System for a given requirement*
5. *Identify proper battery which suits the requirement*

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 or ovens: 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-**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- **Electric Lamps:** Incandescent Lamps, Discharge lamps, Sodium vapour lamps, Mercury vapour lamps, Fluorescent lamps, CFL Lamp, LED Lamp, Stroboscopic effects- 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

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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
Batteries: Classification, Construction and maintenance, Charging and rating of Lead acid batteries and SMF batteries

Text Books:

1. C L Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy', 3rd Edition New Age International Publishers, 2015.
2. B.L. Theraja, 'A Textbook of Electrical Technology' Volume-III, Transmission and Distribution. S. Chand and Company, 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' R K. Rajput, 2nd Edition, Laxmi Publications (P)Ltd, 2016.

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ME 419

Industrial Administration and Financial Management
(for ECE and EEE)

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Students able to learn

1. The roll importance and functions of Management in Industrial Organization
2. Various types of business organizations and organization structures.
3. Importance of plant location and plant layout
4. Importance of industrial engineering like method study and work measurement.
5. The importance of project management techniques
6. 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 and importance of management and its principles.
2. Understand the need and importance of various types of layouts used in manufacturing industries
3. Apply the techniques of method study and work measurement in industry to enhance productivity
4. Apply the techniques of project management in industry
5. Understand the importance of quality control and plot the control charts
6. 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.

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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 Publishing. House, New Delhi, 1994
2. James C Van Horne, and John M Wachowicz, Jr., *Fundamentals of Financial Management*, 13th Edition, Prentice Hall Financial Times
3. Khanna O.P, '*Industrial Engineering and Managemen't*, Dhanapat Rai & Sons

Suggested Reading:

1. S.N. Chary, '*Production and Operations Management'*, Tata McGraw Hill, 3rd Edition, 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 and Ronald J. Ebert, '*Production & Operations Management'*, Prentice

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EE 471 HIGH VOLTAGE ENGINEERING (Elective -III)

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives

1. *Understand the breakdown mechanism in gases, liquids and solid dielectrics.*
2. *Understand the methods of generation and measurement of high voltages and currents.*
3. *Understand the procedure for testing of high voltage equipment.*

Course Outcomes After completion of the course the student will:

1. *Acquire knowledge in breakdown mechanism in Gases and specially pertaining to high voltage engineering and in importance.*
2. *Acquire knowledge in different aspects of breakdown mechanism in liquids and solids specifically pertaining to high voltage aspect.*
3. *Acquire knowledge in respect of generation of High Voltages and currents, generation of impulse voltage and currents. To Analyze multistage impulse generation of impulses voltages and current generation.*
4. *Acquire knowledge relating to measurement of high AC currents, High DC currents measurement of impulse currents and associated measuring equipment.*
5. *Acquire knowledge in testing of high voltage electrical equipment such as power capacitor, power transforms, circuit breaker, insulator, bushings, cables, surge arresters etc.*

UNIT-I: Breakdown mechanism in Gases

Mechanism of breakdown, Types of collisions, Ionization processes, Townsend's First and second Ionization coefficients, Townsend's breakdown mechanism, Time lags for breakdown, Streamer theory of breakdown, Paschen's Law, Penning effect, Corona discharges.

UNIT II: Breakdown mechanism in liquids and solids

Breakdown in liquid dielectrics: Classification of liquid dielectrics, Pure liquids and commercial liquids, conduction and breakdown in pure liquids and commercial liquids. Testing of transformer oil. Breakdown in solid dielectrics: Intrinsic breakdown, Electro-mechanical breakdown, Thermal breakdown, Breakdown due to treeing and tracking, Breakdown due to internal discharges.

UNIT-III: Generation of High Voltages and Currents

Generation of Hugh DC voltages: Half and full wave rectifier circuits, Voltage doubler circuits, Cockroft Walton voltage multiplier circuit. Generation of Hugh AC voltages: Electrostatic generator, Van de Graf generator, Cascaded transformers, Series resonant circuit. Generation of Impulse Voltages and Currents: Analysis of impulse generator circuit, Multistage Impulse generator circuit, Impulse current generation.

UNIT-IV: Measurement of High Voltage and Currents

Sphere gap, Uniform field spark gap, Rod gap, electrostatic voltmeter, Generating voltmeter, Chubb Fortescue method, Impulse voltage measurement using voltage dividers. Measurement of high D.C currents using Hall generators, Measurement of high A.C currents using current transformer and electro-optical system. Measurement of Impulse currents: Resistive shunts, Rogouuski coils, Faraday generator.

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UNIT-V: Testing of High Voltage Equipment
Testing of Power capacitors. Testing of power transformers. Testing of circuit breaker. Testing of Insulators and bushings. Testing of Cables. Testing of Surge Arresters.

Text Books

1. M.S.Naidu and V.Kamaraju, High Voltage Engineering, 4th Edition, Tata McGraw Hill 2009.
2. C.L. Wadhwa, High Voltage Engineering, Wiley Eastern Ltd.., 2007.

Suggested Reading:

1. E.Kuffel and W.S. Zaengl, High Voltage Engineering, 3rd Edition, Pergamon Press, 2016.

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EE472 COMPUTER METHODS IN POWER SYSTEMS (Elective -III)

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *To study the formulation of various incidence matrices*
2. *To study the formulation of network matrices such as Y_{BUS}, Y_{BR} and Z_{loop} .*
3. *To know about the formation of Z_{BUS} for given power system network.*
4. *To understand the calculation of fault currents using Z_{BUS} in three phase power system network.*

Course Outcomes: After completion of the course, the student will be able to:

1. *Draw the graph and find the network metrics for the given power system network.*
2. *Modify the Z_{bus} 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 Y_{bus}, Y_{BR} and Z_{loop} by Singular Transformation Method, Derivation of Y_{BR}, Y_{loop}, Z_{bus} and Y_{bus} from non-singular transformation method.

UNIT –III: Z_{bus} Algorithm

Formation of Z_{Bus}: Partial network, Algorithm for the Modification of Z_{Bus} 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 Z_{Bus} 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 Z_{BUS} 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 Z_{BUS}, Fault impedance and admittance matrices, Analysis of 3-phase line to ground and double line to ground faults, Flow chart for short circuit study.

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Text Books:

1. Stagg and El-Abiad, 'Computer methods in Power System Analysis', 9^{th} Edition, Tata McGraw Hill, 1983.
2. M.A.Pai, 'Computer techniques in Power System Analysis', 3^{rd} Edition, Tata McGraw Hill, 2014.

Suggested Reading:

1. L.P. Singh, 'Advanced Power System Analysis and Dynamics', 6^{th} Edition, New Age International Publishers, 2014
2. Kusic Gearge L, 'Computer Aided Power System Analysis', 2^{nd} Edition, CRC Press, 2008.

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EE 473 **POWER SYSTEM OPERATION AND DEREGULATION**
(Elective-III)

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives
1. *To understand the importance of optimal power flow in power system operation*
2. *To know how to operate power system as securely as possible*
3. *To understand various methods of state estimation*
4. *To discuss about power system deregulation*
5. *To calculate the available transfer capability of the lines*

Course Outcomes
1. *Able to calculate the optimal power flows for the given power system*
2. *Able to carry out contingency analysis*
3. *Able to determine the state estimation of the system and difference between ***nvential LF and SE.*
4. *Able to understand the benefits of deregulation*
5. *Able to 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

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& 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.

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Text Books:

1. A. J. Wood and B.F.Woollenberg- Power Generation, Operation and Control, 3rd Edition. John Wiley, 2013.
2. P. Venkatesh, B. V. Manikandan, S. Charles Raja and A. Srinivasan, "Electrical Power Systems Analysis, Security, Deregulation"– PHI 2012.
3. K.Bhattacharya, M. Bollen and J.E. Daalder Operation of Restructured Power Systems, 1st Edition Springer Publishers 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

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EE 474 POWER QUALITY ENGINEERING (Elective-III)

Instruction	4 Periods / week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *Understand the theoretical concepts and standards of Power Quality(PQ), and methods to calculate and analyse voltage sag in distribution systems.*
2. *Understand PQ issues and sources in Industrial systems and its mitigation*
3. *Understand the presence and sources of harmonics in industrial and commercial loads.*
4. *To know about devices for controlling and mitigating the harmonics.*

Course Outcomes: After completion of this course, the student will be able to:

1. *Have the knowledge of theoretical concepts and standards of Power Quality and issues in industrial systems*
2. *Have the knowledge to calculate and analyze voltage sag in distribution systems*
3. *Acquire knowledge in identifying sources of harmonic.*
4. *Acquire the knowledge in mitigation of harmonics in industrial and commercial loads systems*
5. *Acquire the knowledge in measurement of PQ problems.*

UNIT I: Introduction

Power Quality (PQ), PQ problems, Sags, Swells, Transients, Harmonics, Interruptions, Flicker, Voltage fluctuations, Notch. PQ Issues, **Transient Over-voltages:** Sources of Transient Over-voltages, Wiring and Grounding, Reasons for Grounding, Typical wiring and grounding problems, Solutions to wiring and grounding problems.

UNIT II: Voltage Sag Analysis:

Voltage sag characteristics, Methodology for computation of voltage sag magnitude and occurrence, Accuracy of sag analysis, Duration & frequency of sags, Faults behind transformers, Effect of pre-fault voltage, Voltage dip problems, Fast assessment methods for voltage sags in distribution systems.

UNIT III: PQ Consideration in Industrial Power Systems

Adjustable speed drive (ASD) systems and applications, Sources of power system harmonics, Mitigation of harmonics, Characterization of voltage sags experienced by three-phase ASD systems, Types of sags and phase angle jumps, Effects of momentary voltage dips on the operation of induction and synchronous motors .

UNIT IV: Harmonics

Harmonic distortion, Voltage versus current distortion, Harmonics versus Transients, Harmonic Indices, Harmonic sources from commercial loads, Harmonic sources from industrial loads, Locating Harmonic sources, Effects of Harmonic distortion, Inter harmonics, Devices for controlling harmonic distortion.

UNIT V: Assessing PQ

Remedies, Customer side of meter, Utility side of the meter, Power quality monitoring, Monitoring considerations, PQ measurement equipment, PQ monitoring standards.

Text Book

1. C.Sankaran, 'Power Quality', CRC Press, 2001
2. R.Sastry Vedam, M.Sarma, "Power Quality- VAr Compensation in Power Systems ", CRC Press, 2009

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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.

EE 475 ELECTRICAL DISTRIBUTION SYSTEMS (Elective-III)

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. *To Study the load characteristics and application of distribution transformers.*
2. *To understand the substation schemes, voltage drop calculation of different service areas.*
3. *To know about primary and secondary distribution systems and their characteristics.*
4. *To study the application of capacitors in distribution systems and distribution automation control functions.*

Course Outcomes: After completion of the course, the student will be able to:

1. *Find the load factors, diversity factor etc. for different systems.*
2. *Acquire the knowledge of substation bus schemes and calculation of rating of substation.*
3. *Find voltage drop and power loss calculations of primary and secondary distribution systems.*
4. *Competent to calculate respective power requirement of distribution systems and requirement of distribution automation system.*
5. *Acquire the knowledge of voltage control methods.*

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, Application of distribution transformers, Types of distribution transformers.

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, Substation application curves, 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, Economic design of secondary's, unbalanced load and voltages.

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 unigrounded 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, Advanced SCADA concepts.

Text Books:

1. Turan Gonen, 'Electric Power Distribution Engineering', 3rd *Edition* TMH, 2016.
2. A.S.Pabla, 'Electric Power Distribution', 6th Edition, TMH, 2012.

Suggested Reading:

1. William Kersting, Distribution System Modeling & Analysis, 3rd *Edition* CRC Press, 2015.
2. S.Sivanagaraju, and V.Sanker, 'Electric power distribution and Automation', Dhanpat Rai & Co, 2012.

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EE 476 POWER SYSTEM RELIABLITY (Elective-III)

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 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 the student 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 load models*
5. *Apply reliability analysis on a given distribution system.*

UNIT –I: Elements of probability theory

Probability distributions: 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 hazarad 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.

UNIT-III: Discrete Markov Chains

General modeling concepts, stochastic transitional probability matrix, time dependent probability evaluation and limiting state probability evaluation. Absorbing states. Continuous Markov Processes: Modeling 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

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UNIT-V:

Distribution System Reliabiliry 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 Publicaitons, 1996.
3.

Suggested Reading:

J. Endrenyi, “ Reliability Modeling in Electrical Power Systems”, Wiley Inter science publications.1978

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EE 481 ELECTRONIC INSTRUMENTATION SYSTEMS (Elective -IV)

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course objectives:
1. To understand the concept of transducers.
2. To know the features of data converters.
3. To understand construction and working details of different signal generators, signal analyzers and CRO.

Course Outcomes: After completion of this course, the student will be able to:
1. To know the effectiveness of data converters.
2. Know the applications of various transducers.
3. Know the suitable signal analyzer which suits for a particular application.
4. Understands how different signal generators can be used.
5. know how to work on CRO for different applications.

UNIT-I: Analog and Digital Measuring Systems
Interfacing Active and Passive Transducers. Amplifiers: Instrumentation amplifiers (Fixed and Programmable gain types and its specifications), Isolation amplifiers (Types and its specifications).

Digital to Analog Converters: R-2R ladder and Inverted ladder DACs. Main DAC specifications. Analog to Digital Converter: R-2R Ladder and Inverted Ladder DACs, Main DAC specifications, Analog to Digital Converters: Parallel (or Flash) ADC successive approximation, ADC Microprocessor compatibility, Dual slope ADC, Principal specifications of an ADC.

UNIT-II: Digital Voltmeters and Multimeters
Simple D.C Voltage attenuator, Current toVoltage converter, Resistance to Voltage Converter, Automatic ranging and Automatic zeroing RMS detector in DMM and RMS and True RMS, Digital Frequency and Time measurements, Frequency Measurements, frequency ratio Time Interval and Pulse width measurements, Scaling and Checking modes. Counting errors, Input signal conditioning, Trigger level, Hysteresis.

UNIT-III: Signal Analysis
Wave Analyzers: Signal analysis and wave Analyzer: Type and Applications. Harmonic Distortion Analyzers: harmonic Distortion, heterodyne harmonic Analyzer or Wave meter, Tuned circuit, Fundamental Suppression. Spectrum Analysis: Block Diagram, Phase locked circuit for the local oscillator, Successive Limiting type of Log IF amplifier.

UNIT-IV: Signal Generators
Fixed and variable Audio frequency oscillator, Audio frequency sine and square wave generator, function generator, square wave pulse generator, random noise generator, TV sweep generator, marker generator and beat frequency oscillator(BFO). synchronized signal generator interfaced with 488 Bus, relay switched attenuator, IEE 488 Electrical interface.

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UNIT-V: Cathode ray Oscilloscope

Block Diagram, Basic Concepts, Vertical amplifier, Time Base, Trigger Delay line and their role in a CRO, Digital storage Oscilloscope, Magnetic Re orders, Digital Interface for Programmable Instrumentation, Description and Sample examples of Automatic Instrumentation.

Text books:

1. H .S. Kalsi, "Electronic Instrumentation", 2nd Edition, TMH publications, 2007.
2. A.K.Sawhney-" A Course in Electrical and Electronics Measurements and Instrumentation", 4th Edition Dhanpat Rai & Sons, New Delhi, 2012.

Suggested reading:

1. E.W Golding **"Electrical** Measurements and measuring Instruments". TMH publications, 2011.
2. Helfrick, Albert D. Cooper, William D, "Modern Electronic Instruments and Measuring Instruments ". Prentice Hall of India, 1992.

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ME 472 **Intellectual Property Rights (Elective – IV)**
(for Mech, Prod, Civil, ECE, EEE, CSE, IT)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:
1. *To introduce fundamental aspects of IP*
2. *Introducing all aspects of IPR acts.*
3. *Creating awareness of multi disciplinary audience*
4. *Creating awareness for innovation and its importance*
5. *Exposing to the changes in IPR culture*
6. *Awareness about 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. *Capable of filing a patent document independently.*
5. *Completely understand the techno-legal business angle of IP. .*
6. *Capable of converting creativity into IP 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.

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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. Cronish W.R1 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, Sweet, Maxwell 4th Edition.

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EC 475 DIGITAL IMAGE PROCESSING (ELECTIVE - IV)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Course Objectives:

1. To Understand the formation of images are formed and represent digitally.
2. To study transform-domain representation of images.
3. To know the principles of image compression and enhancement .
4. Students would be able to solve the problems related to image restoration.
5. To learn lossy and lossless Compression techniques.

Course Outcomes: Student will be able to:

1. Understand how images are formed, sampled, quantized and represented digitally.
2. Learn the properties and applications of transforms like Fourier, DCT, Haar, DWT and WHT.
3. Use the principles of image compression, enhancement and segmentation for practical applications.
4. Implement the image restoration techniques on the given image.
5. Remove the redundancy in an image.
6. Implement algorithms of image processing using MATLAB in real time systems.

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. W.e.f. the Academic Year 2016-17 43 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,” First Indian Reprint 2013, CRC Press, (Taylor &Francis), Yesdee Publications.

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CE 422 DISASTER MITIGATION AND MANAGEMENT
(Elective - IV)

Instruction	4 Periods per week
Duration of Main Examination	3 Hours
Main Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:
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, mechanism causes, consequences and mitigation measures of the various natural disasters including hydro metrological and geological based disasters.*
3. *To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters including chemical, biological and nuclear warfare agents.*
4. *To equip the students with the knowledge of various chronological phases in the disaster management cycle.*
5. *To create awareness about the disaster management framework and legislations in the context of national and global conventions.*
6. *To enable students to understand the applications of geospatial technologies like remote sensing and geographical information systems in disaster management.*

Course Outcomes:
1. *Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at local level*
2. *Ability to 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 natural and human induced disasters for the participatory role of engineers in disaster management.*
4. *Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans*
5. *Ability to understand various participatory approaches/strategies and their application in disaster management*
6. *Ability to understand the concepts of remote sensing and geographical information systems for their effective application in disaster management.*

UNIT-I: Introduction to Natural, human induced and human made disasters

Meaning, nature, types and effects; International decade of natural disaster reduction (IDNDR); International strategy of natural disaster reduction (ISDR)

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UNIT-II: Natural Disasters

Hydro meteorological disasters: Causes, impacts, Early warning systems, structural and non-structural measures for floods, drought and cyclones; Tropical cyclones: Overview, cyclogenesis, drought monitoring and management.; Geographical based disasters: Earthquakes and Tsunami- Overview, causes, impacts, zoning, structural and non-structural mitigation measures; Tsunami generation; Landslides and avalanches: Overview, causes, impacts, zoning and mitigation measures. Case studies related to various hydro meteorological and geographical based disasters.

UNIT III: Human induced hazards

Risks and control measures in a chemical industry, Causes, impacts and mitigation measures for chemical accidents, chemical disaster management, current status and perspectives; 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 and traffic accidents .

UNIT IV: Use of remote sensing and GIS in disaster mitigation and management

Scope of application of ICST (Information, communication and space technologies in disaster management, Critical applications& Infrastructure; Potential application of Remote sensing and GIS in disaster management and in various disastrous conditions like earthquakes, drought, Floods, landslides etc.

UNIT V: Concept of disaster management

Introduction to disaster management, Relationship between Risk, vulnerability and a disaster, Disaster management cycle, Principles of disaster mitigation: Hazard identification and vulnerability analysis, Early warning systems and forecasting; Infrastructure and development in disaster management; Disaster management in India: National disaster management framework at central, state, district and local levels. Community based disaster management.

Text Books:

1. Rajib, S and Krishna Murthy, R.R (2012), "Disaster Management Global Challenges and Local Solutions" Universities Press Hyderabad.
2. Notes / Reading material published by National Disaster Management Institute, Ministry of Home Affairs, Govt. of India.

Suggested Reading:

1. Navele, P & Raja, C.K. (2009), Earth and Atmospheric Disasters Management, Natural and Manmade. B.S. Publications, Hyderabad.
2. Fearn-Banks, K (2011), Crises computations approach: A case book approach. Route ledge Publishers, Special Indian Education, New York & London.
3. Battacharya, T. (2012), Disaster Science and Management. Tata McGraw Hill Company, New Delhi.

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IT 429

INTERNET OF THINGS
(for ECE & EEE)

Instruction	4 L periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites: Programming and Problem Solving, Basic Electronics, Computer Organization

Course Objectives:

1. *To provide an overview of Internet of Things, building blocks of IoT and the real-world applications*
2. *To introduce Rasberry Pi device, its interfaces and Django Framework.*

Course Outcomes:

After successful completion of the course, student will be able to

1. *Understand the terminology, enabling technologies and applications of IoT*
2. *Learn 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 systemsusing the understanding of the Rasberry Pi board and interfacing sensors and actuators with Rasberry Pi*
6. *Develop web applications using python based web application framework called Django.*

Unit I: Introduction & Concepts

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 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,

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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, 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 theRasberry Pi board, Rasberry 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.

Suggested Reading:

1. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014.

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IT 428 **NETWORK SECURITY (for ECE&EEE)**

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites: Data Communications,Computer Networks

Course Objectives:

1. *To introduce the basics of network security*
2. *To familiarize with key distribution and security in the transport layer*
3. *To present wireless network protocols and email security*
4. *To discuss about Internet protocol security and Intruder detection*
5. *To impart knowledge about malicious software and firewalls*

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

1. *Understand the basics of network security and apply related concepts for ensuring security*
2. *Understand the principles of encryption, cryptography and message authentication*
3. *Understand the key distribution and security considerations in the transport layer*
4. *Apply wireless network security protocols and email security*
5. *Understand IP security and Intrusion detection*
6. *Detect malicious software and configure a firewall*

UNIT –I: Introduction
Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security, Standards, **Symmetric Encryption and Message Confidentiality:** Symmetric Encryption Principles, **Public-Key Cryptography and Message Authentication:** Approaches to Message Authentication, Secure Hash Functions, Message Authentication Codes, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures

UNIT – II: Key Distribution and User Authentication
Symmetric Key Distribution using Symmetric Encryption, Kerberos, Key Distribution Using Asymmetric Encryption, X.509 Certificates, Public-Key Infrastructure,**Transport-Level Security:** Web Security Considerations, Secure Socket Layer and Transport Layer Security, Transport Layer Security, HTTPS, Secure Shell (SSH)

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UNIT – III: Wireless Network Security

IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security, Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-to-End Security, **Electronic Mail Security:** Pretty Good Privacy, S/MIME, Domain Keys Identified Mail

UNIT – IV: IP Security

IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, **Intruders:** Intruders, Intrusion Detection, Password Management

UNIT – V: Malicious Software

Types of Malicious Software, Viruses, Virus Countermeasures, Worms, Distributed Denial of Service Attacks, **Firewalls:**The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations

Text Books:

1. William Stallings, Network Security Essentials: Applications and Standards, Fourth Edition, Pearson, 2011.
2. William Stallings, Cryptography and Network Security: Principles and Practice, Sixth edition, Pearson, 2013.

Suggested Reading:

1. Eric Maiwald, "Fundamentals of Network Security", Tata McGraw Hill, 2011.
2. PallapaVenkataram, "Wireless and Mobile Network Security", Tata McGraw Hill, 2010.

Web Resources:

1. http://www.cisco.com/cisco/web/solutions/small_business/resource_center/articles/secure_my_business/what_is_network_security/index.html?referring_site=smartnavRD

2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-857-network-and-computer-security-spring-2014/lecture-notes-and-readings/

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EE 422 **ELECTRICAL SIMULATION LAB**

Instruction	3 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. *Understand the load flows in power system transient stability economic power scheduling to load frequency control.*
2. *To simulate power system fault analysis.*
3. *To practice programming using embedded processor*
4. *To learn to interface various electrical equipments to embedded controller*
5. *To simulate out put sequence using embedded system.*

Course Outcomes: After completion of this course, the student will be able to:

1. *Acquire knowledge to conduct Load frequency studies and study the power systems under transient state .importance of economic optimization of power system and relevance of LFC to maintain constant torque*
2. *Program using embedded processor*
3. *Acquire knowledge in simulation of load flow and transient stability studies.*
4. *To generate the output sequence using micro controller.*
5. *Control the operation of different equipments to embedded controller*

List of Experiments

Part A

1. Simulation of Load Flow Studies.
2. Simulation of Fault Analysis.
3. Simulation of Transient stability studies.
4. Simulation of Economic power scheduling.
5. Simulation of Load Frequency control of one area system.
6. Simulation of Load Frequency control of two area system

Part B

1. Simulation of switching sequence for relay operations.
2. Simulation of switching sequence with time delay.
3. Simulation of relay operations using different ports.
4. Interfacing 7 segment display using SPI through microcontroller.
5. Interfacing ADC through microcontroller.
6. Interfacing DAC through microcontroller.
7. Interfacing stepper Motors through microcontroller.

Note: At least **FIVE** experiments from **PART-A** and **PART-B** should be conducted in the semester.

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EE 423 **GENERAL SEMINAR**

Instruction	3L Periods per week
Sessionals	25 Marks
Credits	1

Course Outcomes: After completion of this course, the student will be able to:

1. *Acquire knowledge in systematic way of carrying out literate survey and select the topic for seminar.*
2. *Acquire knowledge in preparing details summary on the select topic and refer cross reference to gain in depth knowledge on the chosen topic.*
3. *Acquire knowledge in preparing summary highlights the direction in which work has progressed and the gaps.*
4. *Acquire knowledge to fill gaps in highlighting the method of solution.*
5. *Acquire knowledge in summarizing and highlighting the affrication aspects.*

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of the specialization.

Seminar topics may be chosen by the student with advice and approval from the faculty members. Students are to be exposed to the following aspects of seminar presentation.

- Literature Survey
- Consolidation of available information
- Power point presentation
- Technical writing

Each student is required to:

1. Submit a one-page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through power point followed by a 10 minutes discussion.
3. Submit a report on the seminar topic with list of references.

Seminars are to be scheduled from the 3rd week of to the last week of the II-semester.

For award of Sessional marks students are judged on the basis of an oral and written presentation as well as their involvement in the discussions by at least two faculty members.

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EE 901 **PROJECT**

Instruction	6L Periods per week
Semester Examination	Viva-voce
Semester Examination	100 Marks
Sessionals	50 Marks
Credits	9

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

1. *Acquire knowledge in conducting systematic way the literature Survey by referring to reputed journals/ textbooks etc.*
2. *Acquire knowledge in segregating /Classifying the literature survey paper : Design, Analysis, experimental etc.*
3. *Able to prepare a detailed summary of the paper as per the classification and choose the area and topic fitting in to the classification such as simulation studies, experimentation, preparing prototype etc.*
4. *Acquire knowledge to conduct simulation studies/ experimental studies and tabulate the results and compare the perform and chose the design parameter to improve the performance etc.*
5. *Acquire knowledge in writing the project work report in different chapters: Introduction, back ground, description, problem formulation, Analysis, Discussion, results and suggestions for further studies and conclusions.*

Dealing with a real time problem should be the focus of under graduate project.

All projects will be monitored at least four times in the II-semester through individual presentations (Project batch wise).

Every student should maintain a project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Problems can also be invited from the industries to be worked out through undergraduate projects. Efforts may be made such that the projects may be carried out in reputed industries/ research organizations/PSUs.

Sessional marks should be based on the marks, awarded by a monitoring project committee of faculty members as well as the marks given by the guide.

Common norms should be established for final documentation of the project report by the respective department on the following lines:

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1. The project little should be task oriented for example "Analysis and Modeling of................"
2. Objectives of the project should be identified clearly and each student of the project batch should fulfill at least one of the objectives identified. The chapters of the project report should reflect the objectives achieved.
3. Contents of the report should include the following
   a. Title page
   b. Certificate
   c. Acknowledgements
   d. Abstract (limited to one/two paragraphs, page no.1 should start from this)
   e. Contents (Ch. No. Title of the chapter/section Page No.)
   f. List figures (Fig. No. caption of the figure Page No.)
   g. List of Tables (Table. No. Caption of the table Page No.)
   h. List of Symbols (ex. C: Velocity of light 3×10^8 m/s)
   i. Chapter I should be introduction . This should contain sections as objectives of the project, technical approach, literature survey, the importance of the project and organization of the report.
   j. The remaining chapters should include regarding the implementation of the project, results with discussions and conclusions. Students are expected to write about future scope of the project.
   k. References should be indicated as per IEEE or standard format, which should be duly referred in the report.
   l. The algorithms related to the software developed should be thoroughly discussed in Appendices etc..

4. The project reports should be hard bound.

The project report should be evaluated for 100 Marks by the External Examiner.

The project work, if found inadequate in the external examination, the candidate should repeat theproject work with a new problem

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16EEC101 Power Semiconductor Devices and Circuits (Core)

Instruction	: 3L + 1T Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 4

Course Objectives: The objectives of the course are to:

1. *Understand switching characteristics of Power Electronic Devices*
2. *Understand principles of operation of dc-dc converters*
3. *Understand principles of operation of dc-dc converters*
4. *Study the operational principles of resonant converters*
5. *Get familiarity with different types of dc-dc converters used in switching power supplies.*

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

1. *Demonstrate the knowledge of switching characteristics of various power semiconductor devices*
2. *Design dc-dc buck ,boost, buck-boost and Cuk converters*
3. *Demonstrate the knowledge of various PWM techniques used in dc-ac single and three phase inverters*
4. *Analyze various types of resonant converters*
5. *Comprehend various dc-dc converters (with electrical isolation) used in SMPS and also able to demonstrate power supply the protection schemes*

UNIT I

Switching Characteristics: Power MOSFETs and IGBTs, Limitations and Safe Operating Areas (SOAs), Latching in IGBTs. Thyristors-Converter & Inverter grade, GTO, RCT, and MCT.

UNIT II

Switch Mode D.C-D.C Converters: Step-down converter (Buck), Step-up converter (Boost), Buck-Boost converter, Control of D.C-D.C converters, Cuk converter

UNIT III

Switch Mode D.C-A.C Inverters: Pulse width modulated switching schemes, Sinusoidal PWM and Square wave PWM of Single phase Inverters and Three phase Voltage source Inverters, Effect of Blanking time on output voltage in PWM Inverters.

UNIT IV

Resonant Converters: Classification, Basic resonant circuit concepts, Load resonant, Resonant switch converters, Resonant D.C Link Inverters with Zero Voltage Switching, High frequency Link Integral half-Cycle converters.

UNIT V

Power Supply Applications: Overview of switching power supplies, DC-AC converters with electrical isolation, Electrical isolation in the feedback loop, Fly-back converters forward converters, Push pull converters, Full bridge converters, Power supply protection, Applications.

Text Books:

1. Mohan, Undeland, Robbins, 'Power Electronics', John Wiley,2003.
2. Rashid M.H, 'Power Electronics', Prentice Hall of India, 1993.

Suggested Reading:

1. Sen P.C, 'Power Electronics', Tata McGraw Hill Pvt. Ltd., New Delhi, 1987.
2. Singh M.D and Khanchandani K.B, 'Power Electronics', Tata McGraw Hill,2008

With effect from the academic year 2016-2017

16EEC102 Distribution System Planning and Automation (Core)

Instruction	: 3L + 1T Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 4

Course Objectives:

1. *To understand electric distribution system planning aspects*
2. *To understand role and functioning of sub-transmission and distribution sub-stations*
3. *To study the aspects of feeder analysis and improvement of voltage levels with special reference to primary and secondary distribution systems*
4. *To study the application of capacitors in distribution systems.*
5. *To understand distribution automation covering SCADA, CIS, GIS, AMR*

Course Outcomes: After completion of this course, the student

1. *Able to know different planning models in the distribution system planning*
2. *Will have knowledge of role and functioning of sub-transmission and distribution sub-stations*
3. *Capable of doing the primary feeder and secondary feeder voltage drop and power loss calculations*
4. *Competent to calculate the reactive power requirements of distribution system*
5. *Acquire knowledge of different aspects of Distribution automation*
6. *Capable of finding load flow results of distribution system using ladder iterative technique.*

UNIT I

Distribution System Planning: Introduction, Distribution system Planning, Factors effecting planning, Present techniques, Planning models, Planning in the future, Future nature of distribution planning, Role of computer in Distribution planning, Load characteristics and Load models, Wye connected loads, Delta connected loads.

UNIT II

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 III

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, The ladder iterative technique.

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UNIT IV

Secondary Feeders: Secondary voltage levels, Present design practice, Secondary Banking, Economic design of secondaries, Total annual cost equation, Voltage drop and Power loss calculations, Distribution system voltage regulation, Quality of services, Voltage control, Application of capacitors in Distribution system.

UNIT V

Distribution Automation: Distribution Automation, 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.

Text Books:

1. Gonen Turan, 'Electric Power Distribution System Engineering', CRC Press, 2014
2. A.S. Pabla, 'Electric Power Distribution', Tata McGraw Hill, 2011

Suggested Reading:

1. William.Kersting, 'Distribution System Modelling & Analysis', CRC Press, 2012.
2. V. Kamaraju, 'Electrical Power Distribution systems', Tata McGraw Hill, 2009.

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16EEC103 Advanced Computer Methods in Power Systems (Core)

Instruction	: 3L + 1T Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 4

Course Objectives:

1. *To study the importance of incidence matrices of given power system network.*
2. *To form Bus Impedance and Admittance matrices of given power system*
3. *To understand the importance of power flow studies in power systems and study different methods to conduct power flow studies*
4. *To study related mathematical modelling aspects required for power flow studies*
5. *To study SC studies and its importance an power systems*

Course Outcomes: After completion of the course, the student

1. *Will have knowledge to draw network graphs, formulate bus incidence matrices form the graphs*
2. *Able to form and manipulate bus admittance and impedance matrices, based on an understanding of incidence and primitive network, so as to reflect changes in network*
3. *Will take advantage of techniques such as triangularization, LU, LDU factorization for network reduction and solutions.*
4. *Will formulate power flow equations and become adept to solving these equations by applying Gauss-seidel and Newton-Raphson methods.*
5. *Will have knowledge to calculate short circuit calculations for different types of faults*
6. *Will develop algorithms and write programs for power flow solutions by iterative techniques.*

UNIT I

Graph Theory: Network graph, 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, Network Matrix Formation of Y Bus.

UNIT II

Formulation of Z-Bus: Matrix representation of power systems, Triangularization, Gaussian elimination method, LU, LDU, Crowds and Cholesky factorization, Algorithm for formation of Z-Bus matrix, Modification of bus impedance matrix for changes in the network, Addition of branch and link.

UNIT III

Load Flow Studies-I: Concepts of load flow, Classification of buses, Representation of fixed tap setting and on load tap changing transformers, Load flow solution using Gauss-Seidel & Newton-Raphson methods, Treatment of voltage controlled buses, Acceleration factors.

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UNIT IV

Load Flow Studies-II: Decoupled and fast decoupled method, Flow chart and comparison of different methods, Numerical analysis, Distribution Load Flow Methods

UNIT V

Short Circuit Studies: Review of Z_{Bus} calculations, Basic assumption in short circuit studies, Short circuit calculations using Z_{Bus}-System representation, Short circuit calculations for balanced three phase network using ZBUS, Fault impedance and admittance matrices for 3-phase to ground and line to ground faults.

Text Books:

1. Stagg & El-Abiad, 'Computer methods in Power System Analysis', Tata McGraw Hill, 1968.
2. Kusic Gearge L, 'Computer Aided Power System Analysis', - Prentice Hall, 1986.
3. M.A.Pai, 'Computer techniques in Power System Analysis', Tata McGraw Hill, 2006.

Suggested Reading:

1. L.P. Singh, 'Advanced Power System Analysis and Dynamics', New Age International Publishers, 2012.
2. Abhijit Chakrabarti & Sunita Halder, 'Power System Analysis: Operation and Control' Prentice Hall India, 3rd edition 2010.

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16EEC104 Power Systems Stability (Core)

Instruction	: 3L + 1T Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 4

Course Objectives:

1. *To Understand modeling aspects of Synchronous machine and importance of park's transformation to carryout system studies.*
2. *To Understand the stability aspects of power system.*
3. *To Understand the modling aspect of controller such as Excitation system, Turbine and Governor models and FACTS controller.*
4. *To Understand the 'Low Freq Oscillation' occurring in Power System and its importance to mitigate.*
5. *To Understand the phenomena of SSR Oscillation in series compensated transmission network.*

Course Outcomes: After completion of the course, the student will be able to:

1. *Acquire knowledge to model the syn. m/c to carryout system studies.*
2. *Acquire knowledge to evaluate performance of power system form steady state stability, transient stability and voltage stability point of view.*
3. *Acquire to knowledge to model PS controllers such as excitation system, Turbine-Governor FACTS controller for stability studies.*
4. *Acquire knowledge to mitigate low freq Oscillation in power system; improving system damping through supplementary excitation control.*
5. *Acquire knowledge to analyze SSR Oscillation occurring in series compensated network through damping controls and its importance in power transfer and stability of the system.*

UNIT I

Synchronous Machine Modeling: The Synchronous machine, Park's transformation, Flux linkage equations, Voltage equations, Current formulation of state space equations, Per-unit conversion, Normalizing Voltage and torque equations, Torque and power, Equivalent circuits of synchronous machine, Flux linkage state space model, Treatment of saturation Synchronous machine connected to infinite bus, Current , Voltage and flux linkage models.

UNIT II

Steady State Stability: Basic concept of stability, types of stability, Stability criteria for single and multi-machine systems.
Transient Stability: The swing equation for single and multi-machine system, Basic assumptions, Different methods of solution of swing equation, Determination of critical time and critical angle,.
Voltage Stability: Concept of voltage stability, Characteristics of network, Generator and load, for voltage stability, Voltage stability and angular stability in power systems, Factors contributing and affecting voltage stability / collapse, Prevention of voltage collapse, Voltage stability static indices, Reactive power - voltage control, 'P-V' curves and 'Q-V' curves, Power Flow analysis for voltage stability, Voltage critical and angle critical for a two bus system.

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UNIT III

IEEE Excitation, Turbine and Governor Models and Facts Controls: IEEE Excitation System Models - 1, 2, 3. Hydraulic Power and Governor Models, Models for steam turbine, Improvement of Transient stability- SVC, SSSC & UPFC.

UNIT IV

Low Frequency Oscillations: Low frequency oscillation and supplementary controls, Transfer function of low frequency oscillation studies, improving system damping with supplementary excitation, Design of supplementary excitation system, State equation for single machine connected to infinite bus through long transmission line system.

UNIT V

Sub-Synchronous Resonance (SSR): Sub-Synchronous Resonance and Sub Synchronous oscillations in series compensated transmission system, Turbine-Generator Torsional Characteristics, Torsional interaction with power system controls, Sub-Synchronous resonance damping schemes.

Text Books:

1. Yao-Nan-Yu, 'Power System Dynamics', Academic Press, 1983.
2. Prabha Kundur, 'Power System Stability & Control', Tata McGraw Hill Edition, 1993.
3. KR Padiyar, 'FACTS Controllers in Power Transmission & Distribution', New Age International Publishers, 2007.

Suggested Reading:

1. Stagg and El-Abiad, 'Computer Methods in Power systems', McGraw Hill, 1968.
2. P.M. Anderson and A A Foud, 'Power System Control and Stability', IEEE Press, 2002.

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16EEC105 Advanced Electric Drives (Core)

Instruction	: 3L + 1T Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 4

Course Objectives:

1. *To Understand the principles of commutation in converters and study the performance, stability and control aspects of DC motors and Induction motors.*
2. *To Understand the microprocessor based control of electric drives*
3. *To Study the working principles and control aspects of special motors: Brushless DC motor, Switched Reluctance Motor drives.*

Course Outcomes: *After completion of this course, the student will be able to:*

1. *Identify and consider the requirement of power converters for a given application.*
2. *Illustrate the digital methods of DC motor speed control techniques.*
3. *Show how the changes effect in different speed control schemes of Induction motor.*
4. *Analyse the performance of Synchronous motor with and without sinusoidal supply.*
5. *Recognize and formulate problems encountered by special motor drives for a particular application.*

UNIT I

Review of Power Converters: Generalized theory and Kron's primitive machine model; reference frame theory and per unit system; Commutation in Thyristor power converters, Principle of natural commutation and forced commutation, Discontinuous conduction in converters, DC choppers, Force commutated inverters, Frequency conversion. Inverter voltage control, Harmonic neutralisation, Voltage controller.

UNIT II

DC Motor Control: General considerations, Evaluation of a dc drive performance Forced commutation schemes to improve the performance of the drives, Steady-State Analysis of the Three-Phase Converter Controlled rectifiers, Steady-state analysis of chopper controlled dc motors , State space model and digital simulation of dc motors, three phase drives. DC motor speed control using microprocessor(Block Diagram and Flowchart Approach only),

UNIT III

A C Motor Control: Induction Motor (IM): Speed control of IM, Analysis of IM on non sinusoidal voltage waveforms, Analysis of CSI fed IM ,Performance of CSI fed IM, Static slip energy recovery schemes employing Converter cascades in the rotor circuit Dynamic behavior and stability of Variable frequency IM, Induction motor speed control using microprocessor (Block Diagram and Flowchart Approach only).

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UNIT IV

Synchronous Motor (SM) Control: Analysis of SM fed from non sinusoidal supplies, Performance of SM on non sinusoidal voltages, Performance of CSI fed SM, Marginal angle control of SM, stability of SM on non sinusoidal supplies, Synchronous motor speed control using microprocessor (Block Diagram and Flowchart Approach only).

UNIT V

Special Motor Drives: **Switched reluctance motor** drive construction, Working principle, Normalized torque-speed characteristics, Speed Control Schemes,
Brushless DC Motor construction: Working principle, Torque-speed characteristics, Speed Control Schemes,
Solar Powered Drive: motors suitable for pump drives, solar powered pump drives
Battery Powered Drives: battery powered vehicles, basics, current status and scope for growth

Text Books:

1. Vedam Subramanyam, 'Thyristor Control of Electric Drives', Tata McGraw Hill Publishing Co., New Delhi, 1987.
2. G.K.Dubey, Fundamentals of Electrical Drives; Narosa Publishing House, 1995
3. P.S.Bimbra, Generalised theory of Electrical Machines, Khanna Publication, 2006.

Suggested Reading:

1. R. Krishnan, ' Electric Motor Drive: Modeling, Analysis and Control' Prentice Hall of India, 2001.
2. B.K.Bose, 'Power Electronics and AC Drives', Prentice Hall, 2002.

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16EEC106 Flexible AC Transmission Systems (Core)

Instruction	: 3L + 1T Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 4

Course Objectives: Objectives of the course are to

1. *Understand concepts of various FACTS devices and controllers which can be used for interconnected power transmission systems*
2. *Study the various converter topologies used in FACTS*
3. *Study the principles of operation and control of shunt FACTS controllers suitable for reactive power compensation, power flow and stability problems*
4. *Study the principles of operation and control of Series FACTS controllers*
5. *Study the principles of operation and control of 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. *Select 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. *Describe the principles, operation and control of UPFC and also demonstrate the knowledge 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, three-level voltage-sourced converter, Pulse-Width Modulation (PWM) converter, Generalized Technique of Harmonic Elimination and voltage control.

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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.

16EEC107 Power Systems Lab

Instruction : 3 Periods / Week
Internal Marks : 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 the stability studies of transient and steady state*
2. *To simulate and observe behavior of a system during the Short circuit*
3. *To Conduct experiments on a given system to know performance when subjected to various faults*
4. *To Conduct experiments on different types of relays*

Course Outcomes: The student will be able to

1. *Validate the adaptability of economic load dispatch and load flow for a given situation by simulation results.*
2. *Design a controller for FACTS application by simulation*
3. *Demonstrate the effects of different sequence reactances of a synchronous machine by experimentation.*
4. *Acquainted with the characteristics of different relays by experimentation*
5. *Acquire the knowledge to calculate the sequence reactances from fault-study.*

LIST OF EXPERIMENTS

PART A : Simulation

1. Load frequency Control of Single & Two Area System.
2. Economic 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 for different faults
6. Short Circuit Analysis
7. Applications of FACTS controllers
8. Distribution load flow studies

PART B: Hardware

1. To measure negative sequence and zero sequence reactance of synchronous machine.
2. To measure direct axis and quadrature axis reactances of synchronous machine
3. To study the single line to ground fault
4. To study line to line fault
5. To study three-phase fault
6. To study microprocessor based over current relay characteristics
7. To study percentage differential relay characteristics
8. To study over voltage relay
9. To study under voltage relay
10. To measure positive and zero sequence reactance's of three-phase transformer

Note: At least **5** experiments should be conducted from **each part.**

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16EEC108 Power Electronics Lab

Instruction	: 3 Periods / Week
Internal Marks	: 50 Marks
Credits	: 2

Course Objectives:

1. *To Simulate and compare the characteristics of Inverter .*
2. *To Simulate and compare the characteristics of converters*
3. *To simulate and observe the various speed control methods of IM*
4. *To Conduct experiments on various converters and inverters and observe the differences*
5. *To Conduct experiments on different types of speed control techniques of IM and to observe the adaptability for the given situation.*

Course Outcomes: The student will be able to

1. *Analyze the performance of converters and inverters by simulation results.*
2. *Design a control circuit with different orientations of devices by simulation*
3. *Demonstrate the effects of different loads on various converters and inverters by experimentation.*
4. *Acquainted with the different speed control techniques of IM*
5. *Know how to use the simulation software to design and fabricate different power electronic circuits.*

LIST OF EXPERIMENTS:

Part A: Simulation

1. Single phase and Three phase IGBT inverters.
2. PWM inverters.
3. Buck and Buck-Boost converter.
4. Resonant converter.
5. V/f control of three phase induction motor.
6. Three phase AC voltage controller.
7. Performance of three phase controlled rectifier with source inductance.
8. Reactive power compensation using FACTS controllers.

Part B: Hardware

1. Three phase Mc-Murray Bed-Ford inverter.
2. Three phase IGBT inverter.
3. Closed loop control of permanent magnet DC drive.
4. Single phase dual converter.
5. Three phase controlled rectifier with R & RL-Loads.
6. Three phase half controlled rectifier with R & RL-Loads.
7. Three phase step down Cyclo-Converter.
8. Speed control of SRIM using static Kramer's system.

Note: At least **5** experiments should be conducted from **each part**.

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16EEC109 SEMINAR – I

&

16EEC110 SEMINAR – II

Instruction	: 3 Periods / Week
Internal Marks	: 50 Marks
Credits	: 2

Course Outcomes: After completion of this course, the student will be able to:

1. *Acquire knowledge in systematic way of carrying out literate survey and select the topic for seminar.*
2. *Acquire knowledge in preparing detailed summary and to gain in -depth knowledge on the chosen topic.*
3. *Acquire knowledge in preparing summary highlights in the direction in which work has progressed and the gaps.*
4. *Acquire knowledge to fill gaps in highlighting the method of solution.*
5. *Acquire knowledge in communication skills and clarity in expression.*

The student has to give a seminar-I during the first semester and Seminar-II during the second semester, which is evaluated by two faculty members.

The topic for the seminar will be chosen by the student relevant to power electronics or power systems or any other area subjected to the condition of approval by the DRC(Departmental Review Committee).

The student has to submit an abstract on the topic one week before the presentation and a detailed report during the presentation.

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16EEC111 Mini Project

Instruction : 2 Periods / Week
Internal Marks : 50 Marks
Credits : 1

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. General Instructions:

- 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.
- Each student will be allotted to a faculty supervisor for mentoring.

III. 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

IV. 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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16EEC112 PROJECT SEMINAR

Semester Examination	: 100 Marks
Credits	: 6

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

1. *Develop the skills of analyzing a problem, solving it by different approaches, building interactions with the other organizations.*
2. *Develop the skills of presenting a concept, independent learning and addressing the societal issues, economical outlay.*

The main objective of project seminar is to prepare the students for the project to be executed in 4th semester.

During the third semester, student will deliver a seminar on the progress of the project, which is evaluated for 100 Marks.

The seminar shall be evaluated by the Departmental Review Committee consists of Head of the Department, Programme co-ordinator and Supervisor.

The student will take up project work at the beginning of the third semester, and will continue till the end of the fourth semester.

The project work is carried out for one academic year / two semesters (i.e. 3rd and 4th semesters).

No external examination for Project Seminar.

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16EEC113 Project Work & Dissertation

Internal Examination	: 100 Marks
Semester End Examination	: 100 Marks
Credits	: 12

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

1. *Acquire knowledge in conducting systematic way the literature Survey by referring to reputed journals/ textbooks etc.*
2. *Acquire knowledge in segregating /Classifying the literature survey paper: Design, Analysis, experimental etc.*
3. *Able to prepare a detailed summary of the paper as per the classification and choose the area and topic fitting in to the classification such as simulation studies, experimentation, preparing prototype etc.*
4. *Acquire knowledge to conduct simulation studies/ experimental studies and tabulate the results and compare the performance and choose the design parameter to improve the performance etc.*
5. *Acquire knowledge in writing the project work report in different chapters: Introduction, back ground, description, problem formulation, Analysis, Discussion, results and suggestions for further studies and conclusions.*

During the fourth semester, student will deliver seminar, which enables to evaluate the preparedness, sufficiency of the work carried out, results etc. On satisfactory recommendation by the Departmental Review Committee, student will prepare the report as per the guidelines issued by the department. The project is evaluated internally for 100 marks and externally for 100 marks.

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16EEE101 **Machine Modeling and Analysis (Elective)**

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course Objectives*:* To understand

1. *The concepts of reference frame theory and basic principles to carryout machine analysis*
2. *The modelling aspects of Synchronous Machine and Study the dynamic performance aspects.*
3. *The modelling aspects of DC Machine and Study the dynamic performance aspects.*
4. *The modelling aspects of Induction Machine and Study the dynamic performance aspects.*

Course Outcomes: After completion of this course, the student will be able to:

1. *Model mathematically all types of DC machine using state variable form*
2. *Obtain stability conditions of all types of DC machines using their characteristic equation deriving from transfer function of the machine.*
3. *Transform variables from one reference frame to another reference frame.*
4. *Model 3Q symmetrical induction machines using reference frame theory under study state condition.*
5. *Analyze the 3Q symmetrical induction motor dynamic performance during transient condition.*
6. *Model 3Q synchronous machines using transformation of reference frames by Park's transformation under steady state and analyze dynamic performance during transient conditions.*

UNIT I

Basic Principles for Electric Machine Analysis: Magnetically coupled circuits, Electro-mechanical energy conversion, Basic Two pole DC Machine, Primitive 2 axis machine, Voltage and Current relationship, Torque equation.

UNIT II

Theory of DC Machines: Mathematical model of separately excited DC Motor, DC Series Motor, DC shunt motor and D.C. Compound Motor in state variable form, Transfer function of the motor.

UNIT III

Reference Frame Theory: Equations of transformation, Change of variables, Stationary circuit variables Transformed to the Arbitrary Reference Frame, Commonly used reference frames, Transformation between reference frames, Transformation of a balanced set, Balanced steady state Phasor, Relationships, Balanced steady state equations, Variables observed from various frames.

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UNIT IV

Theory of Symmetrical Induction Machines: Voltage and torque equations in machine variables, Equations of transformation for Rotor circuits, Voltage and torque equations in arbitrary reference frame variables, Analysis of steady state operation, State-space model of induction machine in 'd-q' variables, Free Acceleration Characteristics, Dynamic Performance during sudden changes in load- during a 3 phase fault at the machine terminals.

UNIT V

Theory of Synchronous Machines: Voltage and Torque equations in machine variables, Stator Voltage equations in Arbitrary Reference Frame Variables, Voltage Equations in Rotor Reference Frame Variables: Park's Equations, Torque Equations in Substitute Variables, Analysis of steady state operation, Dynamic performance, During sudden changes in Input Torque, During a 3 phase fault at the machine terminals.

Text Books:

1. C.V. Jones, 'Unified Theory of Electrical Machines' Butterworths Publishers, 1968.
2. P.S. Bhimbra, 'Generalized Theory of Electrical Machines', Khanna publishers,1995.

Suggested Reading:

1. Paul C. Krause, Oleg Wasynczuk, Scott D.Sudhoff, 'Analysis of Electric Machinery and drive systems' John Wiley and Sons, 2013.
2. J. Meisel, 'Principles of Electromechanical Energy Conversion', McGraw Hill, 1984.

16EEE102 **Modern Control Theory**
(Elective)

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course Objectives: The objective of the course is to

1. *Understand state space representation of systems and study controllability, and observability aspects.*
2. *Understand the problem formulation of non-linear systems and Study the performance*
3. *Understand different types of adaptive control systems and its application aspects.*

Course Outcomes: After completion of this course, the student will be able to

1. *Acquire knowledge to represent the system in state space form and analyze controllability and observability aspects*
2. *Have knowledge in problem formulation of non-linear systems and to analyze its performance.*
3. *Acquire knowledge in defining the stability of a non-linear system using Lyapunov stability method*
4. *Acquire knowledge in formulating an optimal control problem and finding its solution using mathematical modeling*
5. *Acquire knowledge pertaining to Adaptive control systems and applications.*

UNIT I

State Space Analysis: Review of state variable representation of systems, controllability and observability, model control of single input, single output systems (siso), controllable and observable companion forms, effect of state feedback on controllability and observability, pole placement by state feedback.

UNIT II

Non Linear Systems: Classification of Non-linearities, Phenomenon exhibited by the nonlinearities, Limit cycles, Jump resonance Sub-harmonic oscillations, Phase plane analysis, Singular points, Construction of phase plane trajectories, Isocline method, Delta method, Measurement of time on phase plane trajectories.

UNIT III

Stability Studies: Concept and definition of stability, Lyapunov stability, Lyapunov's first and second methods, Stability of linear time invariant systems by Lyapunov's second method, Generation of Lyapunov functions, Variable gradient method, Krasooviski's method.

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UNIT IV

Optimal Control: Formulation of optimal control problems, Calculus of variations, Fundamental concepts, Functionals, Variation of functional, Fundamental theorem of calculus of variations, Boundary conditions,Constrained minimization, Dynamic programming, Hamilton Principle of optimality, Jacobi Bellman equation, Potryagins minimum principle.

UNIT V

Adaptive Control: Introduction to adaptive control, types of adaptive control systems, design of model reference adaptive control systems using m/t rule and lyapunov stability theory.

Text Books:

1. IJ Nagarath , M.Gopal, 'Control Systems Engineering' , New Age International Publishes, Wiley Eastern Ltd., 2006.
2. Ogata K, 'Modern Control Engineering', Prentice Hall, 2010.

Suggested Reading:

1. Donald E Kirk, 'Optimal control theory - An introduction , Dover Publications, 2004.
2. Karl J Astrom Bjron wittenmark, 'Adaptive control', Pearson Education, 1994.

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16EEE103 Advanced Power System Protection (Elective)

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course Objectives: *The objective of the course is to*

1. *Study the operating principles and application aspects of static relays*
2. *Learn different types of differential relays and its application to power systems*
3. *Understand the protection philosophy of Generator, Motor, and transformers*
4. *Disseminate with the general principles of pilot protection and travelling wave relays.*

Course Outcomes: *After completion of the course, the student 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 characteristics & application of different protection schemes for AC generators / motors.*
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

Generator and Motor Protection: Generator protection against short circuits using differential relays against inter-phase fault, Combined split-phase and overall differential relays, Protection against stator open circuits, Rotor and Stator overheating, Loss of excitation protection, Field & ground fault protection, Digital protection scheme based upon second harmonic current induced in the rotor field circuit.

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UNIT IV

Transformer Differential Protection: Effect of magnetizing inrush currents, Grounding transformers, Bus zone protection with differential relays, 3-zone protection using distance relays, 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.

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16EEE104 Real Time Applications in Power Systems (Elective)

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course Objectives:

1. *To understand the need for real-time computer control of power system. Functional aspects of Energy control centre and Energy management system.*
2. *To understand the difference between conventional load-flow and State Estimation in power system.*
3. *To understand the importance of contingency analysis at planning stage for secured operation of power system.*
4. *To understand the importance of security analysis in power system for stable operation.*
5. *Understand the concept of operation of power system in de-regulated environment and familiarize with the salient features of Electricity Act 2003 and Indian Electricity Grid code.*

Course Outcomes: After completion of this course, the student will be able to:

1. *Acquire knowledge in real-time computer control of power system and functional aspects of energy control centre and management system.*
2. *Acquire knowledge to distinguish the difference between load-flow studies and state estimation and role of SE in energy control centre.*
3. *Acquire knowledge in studying the importance of contingency analysis at planning stage for secured operation of power system; and simulating the contingency studies with different methods.*
4. *Acquire knowledge in studying the importance of security analysis and challenges in secured operation of power system in real-time environment.*
5. *Acquire knowledge to study the operation of power system in de-regulated environment and grasp the salient features of Electricity Act 2003 and Indian Electricity Grid Code.*

UNIT I

SCADA / EMS: Need for real-time and computer control of power systems, Operating states of power system, Supervisory Control and Data Acquisition (SCADA), Implementation considerations in Energy Control centers, Functional aspects of Energy Management System, Software requirements for implementing the above functions.

UNIT II

State Estimation Techniques: Definition of State Estimation, Difference between Load Flow and State Estimation, Types of measurements, Data acquisition, Role of a state estimator, Rationale of state estimation, Method of least squares for state estimation. Estimation of power system state variables by the Weighted Least Square Estimation (WLSE) technique. Pseudo-measurements, Statistical errors and bad data recognition, Power system state estimator in noisy environment. Composition of the Jacobian matrix H and the measurement vector Z. Observability in State Estimation. Applications of Power System State Estimation. Role of Phasor Measurement Units (PMU).

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UNIT III

Contingency Analysis Techniques: Security in a power system, Approximations in contingency analysis, Simulation of addition and removal of multiple lines in a power system, Simulation of tie lines in inter connected power systems, Network reduction for contingency analysis, Contingency analysis and approximate power flow method for simulating contingencies.

UNIT IV

Power System Security: Introduction. Challenges for secure operation, Methods of enhancing security, Reliability criterion, Enhancement of stability controls, On-line dynamic security assessment, Management of system reliability, Future trends in dynamic security assessment, Real time monitoring and control.

UNIT V

Introduction to Power System Deregulation: Operation of vertically integrated power systems, Models and examples of deregulated operation, New operation and planning policies, Generation scheduling, Independent power producers, Cogeneration, Power wheeling, Salient features of Electricity Act 2003 and Indian Electricity Grid Code.

Text Books:

1. Allen J Wood and Bruce F. Wollenberg, 'Power Generation, operation and control', John Wiley &Sons, 1996.
2. T.K.Nagsarkar, M.S.Sukhija, 'Power system analysis', Oxford publications, 2007.
3. Prabha Kundur, 'Power system stability and control', Tata McGraw /Hill Edition, 1993.

Suggested Reading:

1. J.Arrillaga, C.P.Arnold, 'Computer modeling of electric power systems', John Wiley, 2013.
2. L.P. Singh, 'Advanced Power System Analysis and Dynamics', Wiley eastern Ltd., 2006.
3. C.W. Taylor, 'Power System Voltage Stability', McGraw Hill, 1994.
4. Lai L.L, 'Power system restructuring and deregulation', John Wiley & sons, 2001.
5. Edmund Handschin (Editor), 'Real Time Control of Electric Power Systems', Elsevier Publishing Co., 1976.

16EEE105 **Deregulation of Power Systems (Elective)**

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 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, B*ilateral markets
3. *To understand the transmission pricing methodologies*
4. *To understand different aspects of managing ancillary services.*
5. *To understand the open access same time information system.*

Course Outcomes: After completion of the course, the student will be able to

1. *Have knowledge in analyzing the operation of power system in de-regulated and competitive environment*
2. *Acquire knowledge in operation and planning policies, in deregulated environment.*
3. *Have knowledge of transmission pricing methodologies.*
4. *Know the different ancillary services provided by the ISO*
5. *Acquire the knowledge of open access same time information system.*
6. *Acquire the concepts of available transfer capability and methodologies to calculate ATC*

UNIT I

Introduction to Power System Deregulation : Operation of vertically integrated power systems, Restructuring process, 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.

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.

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.

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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.

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.

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.

Suggested Reading:

1. M.Ilic, F.Galiana and L.Fink, 'Power System Restructuring Engineering and Economics', Kluwer Academic Publishers 1998
2. Md Shahidephpour and M. Alomoush, 'Restructured Electrical Power Systems', Marcel Dekker Inc, 2001.

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16EEE106 Soft Computing Techniques to Power Systems (Elective)

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course Objectives: The objective of the course is to

1. *Understand basics of advanced optimization algorithms: ANN, FUZZY, Genetic, Particle Swarm Optimization, Ant Colony search algorithms*
2. *Understand the techniques to apply advanced optimization algorithms to power system problems: Reactive power planning, Distribution network expansion, optimal power flow, loss minimization etc.*

Course Outcomes: After completion of this course, the student

1. *Understand the concepts of ANN*
2. *Acquire knowledge of Fuzzy systems.*
3. *Able to understand fundaments and different selection mechanisms in genetic algorithm*
4. *Acquire knowledge of PSO and its variations.*
5. *Capable of applying ANN, Fuzzy, GA, PSO techniques to power system problems.*

UNIT I

ANN: Difference between Artificial Neuron and Biological Neuron, Activation functions, Single layer and Multi layer ANN, Error Calculation, Training of Neural Network, Learning rate, Learning Algorithms, LMS algorithm, Back propagation algorithm, AVQ algorithm.

UNIT II

Fuzzy Logic: Basic concept of Fuzzy logic, Membership Function, Fuzzy Set Operations and its properties, Fuzzy relations, Fuzzy graphs, Fuzzy analysis, Fuzzy Quantifiers, Fuzzy Inference, Rule based system, Defuzzification methods.

UNIT III

Fundamentals of Genetic Algorithms: Introduction to GAs, Encoding, Fitness Function, Premature Convergence, Basic Operators, Selection, Tournament Selection, Truncation Selection, Linear Ranking Selection, Exponential Ranking Selection, Elitist Selection, Proportional Selection, Crossover, Mutation

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UNIT IV

Fundamentals of Particle Swarm Optimization Techniques : Introduction, Basic Particle Swarm Optimization, Background of Particle Swarm Optimization, Original PSO, Variations of Particle Swarm Optimization, Discrete PSO, PSO for MINLPs, Constriction Factor Approach (CFA), Hybrid PSO (HPSO), Lbest Model

UNIT V

Applications to Power Systems: Distribution Network Expansion, Dynamic Planning of Distribution System Expansion, Reactive Power Planning, Optimal Power Flow Under Contingent Condition with Line Capacity Limit, Optimal Power Flow for Loss Minimization etc.

Text Books:

1. Kwang Y. Lee and Mohamed A. El-Sharkawi, 'Modern heuristic optimization techniques', IEEE press, Wiley-Interscience Publication, 2007.
2. Soliman, Soliman Abdel-Hady, Mantawy, Abdel-Aal Hassan, 'Modern Optimization Techniques with Applications in Electric Power Systems', Springer publications, 2011.
3. Simon haykin, 'Neural Networks: A comprehensive foundation', Pearson Education, 1994.
4. Zimmermann.H.J, 'Fuzzy Set Theory and Its Applications', Kluwer Academic Publishers, 1985.

Suggested Reading:

1. S.N.Sivanandam, S.N.Deepa, 'Principles of soft computing techniques', Wiley publications, 2007.
2. Kalyanmoy Deb , 'Multi-objective optimization using evolutionary algorithms' ,Wiley publications, 2001.
3. S.Rajsekaram, G.A.Vijayalakshmi Pai, 'Neural Networks, Fuzzy Logic and Genetic Algorithms - Synthesis & Applications', Practice Hall India, 2003.

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16EEE107 Renewable Energy Sources (Elective)

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course Objectives:

1. *To understand the working principles and implementation aspects of Solar energy sources.*
2. *To understand the working principles and implementation aspects of Wind energy sources.*
3. *To understand the working principles and implementation aspects of Bio-mass energy sources.*
4. *To understand the working principles and implementation aspects of ocean energy sources.*
5. *To study the advantages, environmental issues and necessity of going in for non-conventional energy sources.*

Course Outcomes: The student will be able to

1. *Know the importance of RES for India and know the factors which influence RES selection*
2. *Design solar thermal applications*
3. *Model solar PV system.*
4. *Design WEC system according to the available environmental condition.*
5. *Distinguish between wind and wave energy systems.*
6. *Design suitable OTEC plant and geothermal plant for the available source of heat.*

UNIT I

Principles of Renewable Energy: Introduction, Energy & Sustainable Development, Scientific Principles of RE, Technical Implications, Social Implications, Types of Energy Resources, Basics of Thermal Energy, Hydel Energy, Nuclear Energy, Solar Energy, Wind Energy, Tidal Energy, Geothermal Energy, Ocean Energy, Indian & Global Energy Resources, Environmental Aspects of Energy, Energy Chain, Cost Effectiveness.

UNIT II

Solar Energy: Introduction, Basics of Solar Radiation, Solar Collectors, Classification, Salient Features, Solar Energy Storage, Solar Pond, Solar Water Heater, Solar Furnace, Solar Refrigeration & Cooling System, Solar Cooker, Solar Thermal Power Plants, Solar PV System, Solar Cell Fundamentals, Solar Cell Characteristics, Materials for Solar Cells, Standalone System, Grid Interactive Solar PV System, Hybrid Solar PV System, Design of Solar PV System for Home Lighting.

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UNIT III

Wind Energy: Introduction, Wind Flow, Power in the Wind, Types of Wind Turbines, Wind Turbine Sizing and System Design, Energy Derived from Wind Turbine, Estimation of required Wind Turbine Power Rating, Social & Environmental Considerations
Wave Energy: Introduction to Wave energy, Power, Wave energy devices.

UNIT IV

Geo Thermal Energy: Introduction, Resources of Geo thermal energy, Geo thermal Power Plants, Comparison with conventional power plants, Advantages & Disadvantages, Potential of Geo thermal energy in India.
Ocean Thermal Energy: Introduction, Working principle of OTEC, Status of OTEC plants, Merits & De-merits,

UNIT V

Hydrogen Energy: Introduction, Hydrogen as a source of renewable energy, Production of Hydrogen, Hydrogen powered vehicles & storages, Hydrogen as a fuel and safety issues.
Bio-Gas Energy: Introduction, Photo synthesis, Aerobic & Anaerobic processes, Classification of Bio-Gas plants, Location of Bio-Gas plant, Size of Bio-Gas plant, Biomass gasification, Power Generation from Liquid Waste, Biomass Energy Program in INDIA.

Text Books:

1. John Twidell & Tony Weir, 'Renewable Energy Resources', Taylor & Francis., 3rd edition, 2015.
2. G.S.Sawhney, 'Non – Conventional Energy Resources', PHI Learning Pvt. Ltd, 2012

Suggested Reading:

1. Chetan Singh Solanki, 'Renewable Energy Technologies – A Practical Guide for Beginners', PHI Learning Pvt. Ltd., 2008.
2. Ashok V.Desai, 'Non – Conventional Energy', New Age International, United Nations University Tokyo, 1990.

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16EEE108 **Reliability Modeling in Power Systems (Elective)**

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course Objectives: The objective of the course is to

1. *Understand the basic principles of reliability as applied to power systems*
2. *Understand the concepts and evaluation procedures of generator capacity reserves, operating reserves*
3. *Study the reliability evaluation of Generation, Transmission and Distribution through appropriate mathematical models.*

Course Outcomes: After completion of this course, the student will be able to

1. *Have the knowledge of principles of reliability applied to power systems*
2. *Acquire the knowledge to carryout evaluation procedures of generator capacity reserves.*
3. *Illustrate the evaluation of operating reserve of a system.*
4. *Acquire knowledge to formulate mathematical models for reliability evaluation of Generation, Transmission.*
5. *Compare and contrast various techniques of evaluation with regard to distribution systems.*

UNIT I

Introduction: The Concept of reliability, Reliability Indices, Power System Reliability, Component Reliability, Non-repairable components, Hazard Models, System Reliability, Network methods, Logic Diagrams, Monotonic Structures.

UNIT II

Generating Capacity Reserve Evaluation: Planning for reliability, Outage definitions, Construction of reliability models, Probability of capacity deficiency, Loss of load method, Loss of energy method, Frequency and duration method, Two level representation of the daily load, Merging the generation and load models, Multilevel representation of the daily load, Comparison of the reliability indices, Generation expansion planning.

UNIT III

Operating Reserve Evaluation: General concepts, PJM method, Outage replacement rate, Generation model, Unit commitment risk, Modified PJM method, Area risk curves, Modelling rapid start units, Modeling hot reserve units, Unit commitment risk, Security function approach, Security function model, Response risk, Evaluation techniques, Effect of distributing spinning reserve, Effect of Hydro electric units, Interconnected systems

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UNIT IV

Generation and Transmission Systems: Introduction, Radial configurations, Conditional probability approach, Network configurations, State selection, Systems and load point indices. Application to practical systems, Data requirements for composite system reliability evaluation concepts. Deterministic data, Stochastic data, Independent outages, Dependent outages, Common mode outages, Station originated outages.

UNIT V

Distribution Systems: Introduction, Basic evaluation techniques, State space diagrams, Approximate methods, Network reduction method, Failure modes and effects analysis, Temporary and transient failures, Concepts, Evaluation techniques, Common mode failures, Evaluation techniques, Sensitivity analysis, Total loss of continuity(TLOC), Partial Loss of Continuity(PLOC), PLOC criteria, Extended load, Duration curve, Effect of transferable loads, General concepts, Evaluation techniques, Economic considerations

Text Books:

1. Roy Billiton, Ronold N.Allan, 'Reliability Evaluation of Power Systems', Plenum press, Springer International Edition, 1996.
2. E.Balaguruswamy, 'Reliability Engineering', Tata McGraw Hill Education Publishers, 1984.

Suggested Reading:

1. Endrenyi, 'Reliability Modeling in Electrical Power Systems', John Wiley & Sons, 1979.
2. Sankar.V "System Reliability Concepts", First edition, Himalaya Publishing House, 2015

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16EEE109 **Power Quality Engineering (Elective)**

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course Objectives:

1. *Understand the theoretical concepts and standards of Power Quality (PQ), and methods to calculate and analyse voltage sag in distribution systems.*
2. *Understand PQ issues and sources in Industrial systems and its mitigation*
3. *Understand the presence and sources of harmonics in industrial and commercial loads.*
4. *To know about devices for controlling and mitigating the harmonics.*

Course Outcomes: After completion of this course, the student will be able to

1. *Have the knowledge of theoretical concepts and standards of Power Quality and issues in industrial systems*
2. *Have the knowledge to calculate and analyze voltage sag in distribution systems*
3. *Acquire knowledge in identifying sources of harmonic.*
4. *Acquire the knowledge in mitigation of harmonics in industrial and commercial loads systems*
5. *Acquire the knowledge in measurement of PQ problems.*

UNIT I

Introduction: Power Quality (PQ), PQ problems, Sags, Swells, Transients, Harmonics, Interruptions, Flicker, Voltage fluctuations, Notch. PQ Issues, Assessing PQ: Remedies, Customer side of meter, Utility side of the meter, Power quality monitoring, Monitoring considerations, Historical Perspective of PQ Measuring Instruments, PQ measurement equipment, Assessment of PQ measurement data, Application of intelligent systems, PQ monitoring standards.

UNIT II

Voltage Sag Analysis: Voltage sag characteristics, Methodology for computation of voltage sag magnitude and occurrence, Accuracy of sag analysis, Duration & frequency of sags, Faults behind transformers, Effect of pre-fault voltage, Simple examples, Voltage dip problems, Fast assessment methods for voltage sags in distribution systems.

UNIT III

PQ Consideration in Industrial Power Systems: Adjustable Speed Drive (ASD) systems and applications, Sources of power system harmonics, Mitigation of harmonics, Characterization of voltage sags experienced by three-phase ASD systems, Types of sags and phase angle jumps, Effects of momentary voltage dips on the operation of induction and synchronous motors .

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UNIT IV

Harmonics: Harmonic distortion, Voltage versus current distortion, Harmonics versus Transients, Harmonic Indices, Harmonic sources from commercial loads, Harmonic sources from industrial loads, Locating Harmonic sources, System response characteristics, Effects of Harmonic distortion, Inter harmonics, Devices for controlling harmonic distortion.

UNIT V

Transient Over-voltages: Sources of Transient Over-voltages, Wiring and Grounding, Resources, Definitions, Reasons for Grounding, Typical wiring and grounding problems, Solutions to wiring and grounding problems.

Text Books:

1. C.Sankaran, 'Power Quality', CRC Press, 2002.
2. Bhim Singh, Ambrish Chandra, Kamal Al-Haddad, 'Power quality: problems and mitigation techniques', Wiley publications, 2015.

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*', Tata McGraw-Hill, 2012.

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16EEE110 Energy Management (Elective)

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course Objectives: The objective of the course is to

1. *Understand the general principles of energy management and functions of energy manager.*
2. *Understand the objective and types of Energy Audit and Energy Conservation aspects with reference to EC Act 2001 and Electricity Act 2003.*
3. *Understand the methods to improve energy efficiency of industrial equipment by conducting energy audits and suitable methods for energy conservation in domestic and industrial sectors.*
4. *Understand simple methods in Energy Management and benefits in using energy efficient equipment.*

Course Outcomes: After completion of this course, the student will be able to

1. *Acquire knowledge of Energy management principles and the evolution of EC Act 2001 & 2003.*
2. *Familiar with energy audit instruments and Energy Audit case studies*
3. *Identify the need of Demand side management in the Energy conservation aspect.*
4. *Compare and contrast the Energy efficient systems in various sectors.*
5. *Recognize the role of technology in Energy management perspective.*

UNIT I

Essentials of Energy Management: Introduction, Energy Conservation & its need, Energy Management techniques, Importance of Energy Management, Managing the Energy Consumption, Environmental Aspects, Alternate sources of Energy, Energy Efficiency, Energy Scenario in India, National Institutions promoting Energy Conservation.

UNIT II

Energy Auditing: Introduction, Need for Energy Audit, Types of Energy Audit, Energy Audit Methodology, Process Flow Diagram, Energy Audit Reporting Format, Bench marking & Energy performance, Matching Energy usage to requirement, Energy Audit Instruments, Energy Efficiency, Energy Audit Case Studies.

UNIT III

Energy Conservation: Introduction, Energy Conservation Act, Practical aspects for Energy Conservation in Domestic Sector, Energy Conservation opportunities in HVAC Systems, Energy Conservation at Macro Level, Demand Side Management, Benefits of DSM, DSM Implementation Strategy, Electricity Pricing.

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UNIT IV

Energy Efficiency: Introduction, Industrial Energy Efficiency, Energy Saving Potential in Industries, Boiler, Furnace, Heat Exchanger, Electrical Drives, Pumps, Fans & Blowers, Energy Conservation in Agriculture Sector, Energy Efficient Motors, BIS Specifications for Energy Efficient Motors.

UNIT V

Application of Technology in Energy Management: Introduction, Power Cables, Amorphous Core Transformer, Intelligent Power factor Controller, Maximum Demand Controller, Soft Starter, Variable Frequency Drives, Energy Management Systems, Industrial Power Management System.

Text Books:

1. W.R.Murphy & G.Mckay, 'Energy Management', Butter worth Heinemann Publications, 2007.
2. Umesh Rathore, 'Energy Management' S.K. Kataria & Sons., 2013.

Suggested Reading:

1. K.V.Sharma, P.Venkataseshaiah, 'Energy Management and Conservation' IK International Publishing House Pvt. Ltd., 2011.
2. Turner W.C., 'Energy Management Handbook', 1982.

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16EEE111 Advanced Microprocessor Systems (Elective)

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course Objectives: The objective of the course is to

1. *Understand Architecture features and function of 8086, 80386, 80486, Pentium, Motorola 68000 microprocessors.*
2. *Understand features of MIPS, AMD.*
3. *Understand basics of 68020, 68030 and 68040 Microprocessors*
4. *Understand the features of RISC*
5. *Understand Dec Alpha AXP and Sun SPARC*

Course Outcomes: After completion of this course, the student will be able to

1. *Have knowledge of Architecture features and function of 8086, 80386, 80486, Pentium, Motorola 68000 microprocessors.*
2. *Have knowledge of features of MIPS, AMD,*
3. *Acquire basic knowledge on 68020, 68030 and 68040 Microprocessors*
4. *Acquire knowledge of functional features of RISC, Dec Alpha AXP and Sun SPARC*
5. *To get basic knowledge on Pentium , Pentium pro Pentium II Pentium III features of Pentium series microprocessors*

UNIT I

8086 Microprocessor: Architecture, Segmented Memory, Addressing Modes, Instruction Set, 8086 Assembly Language Programming, 8087 Numerical Data Processor Architectural details, Data types, Floating point Operations, 8087 Instructions.

UNIT II

Architectural details of 80386 Microprocessor: Special registers, Memory management, Operation in protected mode and virtual 80386 mode, Memory paging mechanism, Special instructions of 80386, Architectural details of 80486, Special registers, Additional instructions, Comparison of 80386 and 80486 processors.

UNIT III

Introduction to Pentium Processor: Architectural features, Comparison with the workstations, Branch prediction logic, Cache structure, Special Pentium Registers, Memory management, Virtual mode of operation, Comparison with the previous processors, Features of Pentium-II, Pentium-III and Pentium Pro-processors.

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UNIT IV

RISC Microprocessors: RISC Vs CISC, RISC Properties, DEC Alpha AXP Architecture, Power PC, Architecture, Programming Model, Data Types, Addressing Modes, Instruction Set, Sun SPARC, Architecture, Data Types, Instruction Sets, Features of MIPS, AMD Microprocessors.

UNIT V

Motorola Microprocessors: 68000 Microprocessor, Architecture, Registers, Addressing Modes, Features of 68020- 68030- 68040 Microprocessors.

Text Books:

1. Barry B Brey, 'Intel Microprocessors: 8086/88, 80186/188, 80286, 80386, 80486, Pentium, Pentium – II, Pentium – III and Pentium – IV, Architecture, Programming & Interfacing', Pearson Education, 2009.
2. Badri Ram, 'Advanced Microprocessors and Interfacing', Tata McGraw Hill, 2001.

Suggested Reading:

1. A.K. Ray & K.M. Bhurchandi,, 'Advanced Microprocessors & Peripherals, Architecture, Programming & Interfacing', Tata McGraw Hill, 2006.
2. Daniel Tabak, 'Advanced Microprocessors', McGraw Hill, 1991.

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16EEE112 Digital Control Systems (Elective)

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course Objectives: The objective of the course is to

1. *Understand the concepts of Z-transforms, System representation in state space form and analyze stability, controllability, observability aspects.*
2. *Study the design methodology of Discrete time control systems through conventional methods.*
3. *Understand the importance of pole placement and design of state feedback controllers.*
4. *Understand the concepts and features of adaptive controls and State Estimation through Kalman filters*

Course Outcomes: After completion of this course, the student will be able to

1. *Acquire knowledge on Z-transforms and their importance in finding Pulse Transfer Function.*
2. *Acquire knowledge on developing a discrete time system in state space form and also to analyze stability, controllability, observability aspects*
3. *Acquire knowledge to design discrete time control systems through conventional methods using compensators and PID controllers*
4. *Have knowledge of pole placement and design of state feedback controllers*
5. *Acquire knowledge of Adaptive controls and State Estimation through Kalman filter*

UNIT I

Review of Z-Transforms: Introduction, Linear difference equations, Pulse response, Z-transforms, Theorems of Z-Transforms, Inverse Z-transforms, Modified Z-Transforms, Z-Transform method for solving difference equations, Pulse transforms function, Block diagram analysis of sampled data systems, Mapping between s-plane and z-plan, Primary strips and Complementary Strips.

UNIT II

State Space Analysis : State Space Representation of discrete time systems, Pulse Transfer Function, Matrix solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state - space equations.

UNIT III

Controllability and Observability: Concepts of Controllability and Observability, Tests for controllability and Observability, Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function. Stability Analysis (Discrete), Stability Analysis of closed loop systems in the Z-Plane,Jury stability test, Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion, Stability analysis using Liapunov theorems.

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UNIT IV

Design of Discrete Time Control System by Conventional Methods: Design of digital control based on the frequency response method, Bilinear Transformation and Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers, Design of digital control through deadbeat response method.

UNIT V

State Feedback Controllers and Observers(Discrete): Design of state feedback controller through pole placement, Necessary and sufficient conditions, Ackerman's formula, State Observers, Full order and Reduced order observers, Min/Max principle, Linear Quadratic Regulators, Kalman filters, State estimation through Kalman filters, Introduction to adaptive controls.

Text Books:

1. K. Ogata, 'Discrete-Time Control systems', Pearson Education/PHI, 1995.
2.M.Gopal , 'Digital Control and State Variable Methods ' , Tata McGraw Hill, 2003.

Suggested Reading:

1. Kuo B.C., 'Digital Control Systems', Oxford University Press, 1977.
2. M. Gopal, 'Digital Control Engineering', New Age International, 1988

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16EEE113 **HVDC Transmission (Elective)**

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course Objectives:

1. *To understand the HVDC converter analysis and its control*
2. *To understand the methods of fault protection in HVDC system*
3. *To understand the AC-DC system interactions and about multi-terminal DC systems*

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

1. *Acquire knowledge about HVDC converter operation and methods of control*
2. *Acquire knowledge about methods of HVDC converter control*
3. *Acquire knowledge about the protection methods in HVDC system*
4. *Acquire knowledge about AC-DC system interactions*
5. *Acquire knowledge about multi-terminal DC systems*

UNIT I

HVDC Power Transmission Technology: Comparison of AC and DC Transmission system, Applications of DC Transmission, Types of DC links, HVDC converter station, Modern trends in HVDC Technology, Analysis of Graetz circuit neglecting overlap, Analysis of two and three valve conduction mode, Equivalent circuits of Rectifier and Inverter.

UNIT II

HVDC Converter System Control: Principles of DC link control, Individual phase control, Firing angle control, Extinction angle control, Starting and stopping of DC link, Reactive power control using SVC and STATCOM, Characteristics and direction of DC power flow.

UNIT III

Converter Faults and Protection: Types of Converter faults, Over current protection, Over voltages on DC side, Over voltages due to AC disturbances, Transients in DC system, Insulation co-ordination, Smoothing reactors, DC Breakers, Characteristic and Non-characteristic harmonics, Design of AC filters, DC filters.

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UNIT IV

Analysis of AC-DC System Interactions: Basic converter model, Power flow analysis with VSC based HVDC system, Modeling of converter controller, Modeling of DC network, Modeling of AC network, Transient analysis of DC and AC networks.

UNIT V

Multi-Terminal DC Systems: Applications of MTDC systems, Types of MTDC systems, Comparison of series and parallel MTDC systems, Control of MTDC systems, Protection of MTDC systems, Multi-infeed DC systems.

Text Books:

1. Padiyar K R., HVDC Power Transmission Systems, New Age International, New Delhi, 2010
2. S.Kamakshaiah,V.Kamaraju,' HVDC Transmission', Tata McGraw-Hill Education Pvt. Ltd., 2011

Suggested Reading:

1. Arrillaga J., High Voltage Direct Current Transmission, Peter Peregrinus Ltd., London. 1983.

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16EEE114 Research Methodology & Professional Ethics (Elective)

Instruction	: 3 Periods / Week
Duration of Semester Examination	: 3 Hours
Semester End Examination	: 70 Marks
Sessional	: 30 Marks
Credits	: 3

Course objectives:

1. *To understand research problem formulation and distinguish types of research*
2. *To understand concepts, need and features of research design, developing research plan and get familiar with codes and standards.*
3. *To understand the method of writing research project proposal*
4. *To understand the method of Report writing and technical paper writing*
5. *To understand the importance of professional ethics, IPR issues.*

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

1. *Acquire knowledge in distinguishing the difference in types of research and formulate area of research in a systematic manner.*
2. *Acquire knowledge to prepare research design, outline important concepts, following relevant standards and codes, and their importance in analysis.*
3. *Acquire knowledge in preparing research project proposal outlining the objectives, deliverables, and beneficiary's financial requirements in preparing the report.*
4. *Acquire the knowledge of report writing, technical paper writing and Journal paper writing.*
5. *Acquire the knowledge of Intellectual property rights, citation etc.*
6. *Acquire the concepts of MOU and MOA.*

UNIT I

Objectives and Types of Research: Motivation and objectives – Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research process

UNIT II

Research Problem Formulation: Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem.
Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, monographs-patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis.

Unit III

Research Design and Methods: Research design – Basic Principles- Need of research design - Features of good design – Important concepts relating to research design – Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. Developing a research plan - Exploration, Description, Diagnosis, Experimentation, use of standards and codes. Determining experimental and sample designs

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Unit IV

Research Proposal and Report Writing: Writing a research proposal, contents, objectives of study, experimental procedures, Format of the research report, style of writing report , interpretation of results, conclusions, references , bibliography, webiography, technical paper writing, journal paper writing

Unit V

Professional Ethics: Ethical issues, ethical committees,Commercialization,Copy right, royalty, Intellectual property rights and patent law, Trade Related aspects of Intellectual Property Rights, MOU and MOA , Reproduction of published material, Plagiarism, Citation and acknowledgement - Reproducibility and accountability.

Text Books:

1. Ranjit Kumar, 'Research Methodology', SAGE south Asia Edition 2012
2. C. R. Kothari , 'Research Methodology' Methods and Techniques' , New Age Publishers,2004
3. P.Narayanan, 'Intellectual Property law', Eastern law House, 2013
4. R. Subramanian, 'Professonal Ethics', Oxford University Press, 2013.

Suggested Reading:

1. Cronish W.Rt , Intellectual property; Patents, copyright, Trade marks and Allied rights, Sweet & Maxwell, 1993
2. Wadehra, B.L., 'Law relating to patents, trade marks, copyright designs and geographical indications'. Universal Law Publishing, 2000.
3. Fink, A., 'Conducting Research Literature Reviews: From the Internet to Paper'. Sage Publications, 2009.
4. Satarkar, S.V., 'Intellectual property rights and Copy right'. Ess Ess Publications, 2000.

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SOFT SKILLS LAB

Code : 16 EG 104

Instruction	2 Periods per week
Duration of Assessment	2 Hours
Final Assessment	Satisfactory/Un-Satisfactory

Course Objectives: To help the students

1. *Participate in group discussions and case studies with confidence and to make effective presentations. Also to learn the art of communication.*
2. *With- resume packaging, preparing and facing interviews.*
3. *Build an impressive personality through effective time management, leadership, self-confidence and assertiveness.*
4. *Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.*
5. *To be competent in verbal aptitude.*

Course Outcomes: The 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 mange 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. *Correct and complete sentences, have a good vocabulary and comprehend passages confidently*

EXERCISE 1

Group Discussion & Case studies – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
Elements of effective presentation – Structure of presentation – Presentation tools – Body language
Creating an effective PPT

EXERCISE 2

Interview Skills – Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets
Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

EXERCISE 3

Personality Development – Effective Time Management, assertiveness, decision making and problem solving, stress management, team building and leadership.

EXERCISE 4

Corporate Culture – Grooming and etiquette, corporate communication etiquette.
Academic ethics and integrity

EXERCISE 5

Verbal Aptitude – Sentence correction, sentence completion, jumbled sentences and vocabulary.
Reading comprehension

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Suggested Reading:

1. Leena Sen , “Communication Skills”, Prentice-Hall of India, 2005
2. Dr. Shalini Verma, “Body Language- Your Success Mantra”, S Chand, 2006
3. Edgar Thorpe and Showick Thorpe , “Objective English”, 2^{nd} edition, Pearson Education, 2007
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, “The ACE of Soft Skills”, New Delhi: Pearson, 2010
5. Gulati and Sarvesh, “ Corporate Soft Skills”, New Delhi: Rupa and Co. , 2006
6. Van Emden, Joan, and Lucinda Becker, “Presentation Skills for Students”, New York: Palgrave Macmillan, 2004
7. A Modern Approach to Verbal & Non-Verbal Reasoning by R S Aggarwal
8. Covey and Stephen R, “The Habits of Highly Effective People”, New York: Free Press, 1989

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16 MT C01

ENGINEERING MATHEMATICS – I

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

Course Objectives:

1. To solve Linear System of Equations using Matrix Methods
2. To Know the Partial Derivatives and use them to interpret the way a function of two variable behaves
3. To analyse the Shape of the Graph of a given Curve
4. To Evaluate Double and Triple integrals of various functions and their significance
5. Formulate and solve the Differential Equations of First Order
6. To know the methods to solve real life problems.

Course outcomes: On the successful completion of this course student shall be able to

1. Solve system of linear equations and identify the Eigen values and Eigen vector in engineering problems
2. Expand and find extreme values of functions of two variables
3. Trace and interpret curve behavior in physical systems
4. Find the areas, volumes and surface of solids revolution
5. Use-differential equations to model engineering phenomena such as circuit theory, networks
6. An ability to solve the problems and interpret it in geometrical approach

UNIT- I

Linear Algebra: Review of Rank & Consistency, Eigen values, Eigen vectors- properties (without proofs). Cayley-Hamilton Theorem (statement only) inverse and powers of a Matrix by Cayley-Hamilton Theorem. Reduction of Quadratic form to Canonical form by linear transformation, rank, positive, negative, definite, semi-definite, index and signature

UNIT- II

Functions of several variables: Partial differentiations, Homogenous function, Euler's theorem, Implicit functions, Jacobins, Taylor"s series in one and two variables, Maxima and Minima for function of two variables with and without constraints

UNIT- III

Differential Calculus: Curvature and Radius of curvature centre of curvature, circle of curvature. Evolutes, involutes and Envelopes, Curve tracing-Cartesian, polar and parametric curves

UNIT- IV

Multiple Integrals: Double Integrals, Triple Integrals, Change of order of Integration, Applications of integration, rectification, areas, volumes and surfaces of solids of revolution in Cartesian coordinates, Centre of Gravity, PAPPUS theorem.

UNIT- V

First order differential equations and its application: Exact differential equations, Orthogonal trajectory's, Electrical circuits, Newtons law of cooling

Text Books:

1. Ervin Kreyszig "Advanced Engineering " 10 Edition, john wiley & sons -publishers
2. A R.K.Jain&S.R.K.Iyenger "Advanced Engineering Mathematics" , 3rd edition, Narosa Publications
3. AlenJaffery "Mathematics for Engineers and Scientists", 6th edition : CRC press, Taylor & Francis Group.(Elsevier),2013

Suggested Reading:

1. Kanti.B.Datta "Mathematical Methods of science and engineering", Aided with MATLAB, .Cengage Learning India Pvt. Ltd, Pratapgang ,New Delhi
2. B.S.Grewal "Higher Engineering Mathematics" , Khanna Publishers
3. William E.Boyce /Richard C.Dip "Elementary differential equations" , 9th Edition

16PY C01

ENGINEERING PHYSICS

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives: The objective of the course is to make the student
1. Understand the general concepts of physics
2. Acquire knowledge of different kinds of waves and their behavior
3. Familiar with crystal physics and materials
4. To introduce the general concepts of physics

Course Outcomes: At the end of the course, the student will be able to
1. Describe the types of oscillations and analyze them
2. Demonstrate the wave nature of the light
3. Develop the concepts related to electromagnetic behavior
4. Identify the various crystal systems and defects
5. Explain the origin of magnetism and dielectric polarization and applications of these materials in the field of engineering & technology

UNIT – I **Waves and Oscillations:** Review of free oscillations - Superposition of two mutually perpendicular linear SHMs of same frequency and 1:2 ratio frequency – Lissajous figures – Damped vibrations – Differential equation and its solution – Logarithmic decrement - Relaxation time – Quality factor – Forced vibrations – Differential equation and its solution – Amplitude resonance- Torsional pendulum.
Ultrasonics: Production of ultrasonics by piezoelectric and magnetostriction methods – Detection of ultrasonics – Determination of ultrasonic velocity in liquids – Applications.

UNIT – II **Interference:** Division of amplitude – Interference in thin films (reflected light) – Newton's rings – & division of wavefront – Fresnel's biprism.
Diffraction: Distinction between Fresnel and Fraunhoffer diffraction – Diffraction at single slit – Diffraction grating (N Slits) – Resolving power of grating.

UNIT – III **Polarization:** Malus's law – Double refraction – Nicol's prism – Quarter & Half wave plates – Optical activity – Laurent's half shade polarimeter.
Electromagnetic Theory: Review of steady and varying fields – Conduction and displacement current – Maxwell's equations in differential and integral forms – Electromagnetic wave propagation in free space, dielectric and conducting media – Poynting theorem.

UNIT – IV **Crystallography:** Space lattice - Crystal systems and Bravais lattices – Crystal planes and directions (Miller indices) – Interplanar spacing – Bragg's law – Lattice constant of cubic crystals by powder diffraction method.
Crystal Imperfections: Classification of defects – Point defects – Concentration of Schottky and Frenkel defects – Line defects – Edge dislocation – Screw dislocation – Burger's vector.

UNIT – V **Magnetic Materials:** Classification of magnetic materials – Langevin theory of paramagnetism – Weiss molecular field theory – Domain theory – Hysteresis curve – Structure of ferrites (spinel & Inverse spinel) – Soft and hard magnetic materials.
Dielectric Materials: Dielectric polarization – Types of dielectric polarization: electronic, ionic, orientation and space-charge polarization (Qualitative) – Frequency and temperature dependence of dielectric polarization – Determination of dielectric constant (Schering bridge method) – Ferroelectricity – Barium titanate – Applications of ferroelectrics.

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 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", McGahill Education Publications, 2013
3. P.K. Palanisamy, Engineering Physics", Scitech Publications, 2012
4. V. Raghavan, "Materials Science and Engineering", Prentice Hall India Learning Private Ltd., 6th Revised edition, 2015

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DEPARTMENT OF ECE
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16CY C02

APPLIED CHEMISTRY

Instruction	2L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	20 Marks
Credits	2

Course Objectives:

Applied chemistry is a fascinating area with the profound implications for engineers as well as biologists. Materials fabricated and used in our daily life are derived from chemicals, both natural and synthetic and their range of utility are growing day by day. It is imperative that engineers of different disciplines acquire sufficient knowledge of the materials and their characteristics for making proper selection of their end -use application.

The various units of the syllabus is so designed to fulfill the following objectives.

1. To impart technological aspects of modern chemistry and to lay foundation for the application of chemistry in engineering and technology disciplines
2. The student should be conversant with the
   i. Principles of water characterization and treatment of water for potable and industrial purposes.
   ii. Principles of polymer chemistry and engineering applications of polymers in domestic and engineering areas
3. Knowledge to prevent corrosion of machinery and metallic materials and water chemistry which require serious attention in view of increasing pollution, has been included in the syllabus.
4. Study of polymers is insisted as it gives better insight to industrial personnel by being exposed to wider aspects of polymer science.
5. Study of fuel cells is given importance as fuel cells are the alternate energy sources for generating electrical energy on spot and portable applications.
6. Newer materials lead to discovering of technologies in strategic areas like defense and space research. Recently modern materials synthesized find applications in industry and technology and in order to emphasize them, topics like composite materials, polymers, conducting polymers and nano materials have been incorporated in the curriculum.
7. To enable students to apply the knowledge acquired in improving the properties of engineering materials.
8. To give an insight into nano materials and composite materials aspect of modern chemistry.

Course Outcomes:

1. At the end of the course, the students will be familiar with the fundamentals of water technology; corrosion and its control; applications of polymers in domestic and engineering areas; nano materials and their applications.
2. The engineer who has the above background can effectively manage the materials in his designing applications and for discovering & improving the systems for various uses in industry, agriculture, health care, technology, telecommunications and electronics.
3. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.
4. Study of nano related materials helps to update the knowledge necessary to launch into the demands of the world.

UNIT –I

Water Chemistry: Hardness of water – Types, units of hardness, Disadvantages of hard water - Boiler troubles - scales & sludge formation - causes and effects, softening of water by ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water, disinfection of water by chlorination, Ozonization, UV radiation.

UNIT -II

Corrosion Science : Introduction, chemical corrosion – oxidation corrosion , electro chemical corrosion and its mechanism , Galvanic corrosion and types of differential aeration corrosion (waterline corrosion) , Factors affecting corrosion (position of the metals in galvanic series, relative areas of anode and cathode, nature of corrosion product – solubility and volatility of corrosion product, nature of corroding environment – temperature, humidity and P^H. Corrosion control methods – cathodic protection, sacrificial anodic protection

UNIT – III

High Polymers: Definition of polymer, degree of polymerization. Thermo plastics and thermo sets. Preparation, properties and uses of plastics (Polyvinyl chloride, Bakelite), fibers (Kevlar, polyurethane), Rubbers – natural rubber and its chemical structure, vulcanization and its significance. Preparation, properties and uses of silicone rubber, conducting polymers – definition, classification and applications

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UNIT – IV

Battery Technology: Types of batteries - Primary batteries - Dry cell, Lithium battery; Secondary batteries - lead acid storage cell , Lithium ion battery ; Fuel cell - H_2-O_2 fuel cell, methanol-oxygen fuel cell – its advantages and applications
Solar cells – photo voltaic cells

UNIT–V

Engineering Materials: Nano materials – Introduction to nano materials and general applications, basic chemical methods of preparation – Sol-gel method. Carbon nanotubes and their applications
Composite materials – definition, types of composites, fibre reinforced, glass fibre reinforced and carbon fibre reinforced composites and applications.

Text Books:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Pub, Co., New Delhi (2002)
2. Applied Chemistry "A text for Engineering & Technology" Springer (2005).
3. ShasiChawla, "Text Book of Engineering Chemistry", Dhanpat Rai Publishing Company, NewDelhi (2008).
4. S.S. Dara "A text book of engineering chemistry" S.Chand & Co.Ltd., New Delhi (2006).
5. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
6. Applied Chemistry by N. Krishnamurthy:P. Vallinavagam. And K. Jeysubramanian TMH
7. Chemistry of Engineering Materials by CV Agarwal,C.P Murthy, A.Naidu, BS Publications.
8. Chemistry of Engineering Meterials by R.P Mani and K.N.Mishra, CENGAGE learning

Suggested Reading:

1. B.K.Sharma, "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001)
2. Water Treatment : F. I. Bilane, Mir publisher
3. Fundamentals of Corrosion: Michael Henthorne, Chemical Engineering.
4. A textbook of Polymer Science: Fred, Billmeyer Jr., Wiley India Third edition.
5. Chemistry of Advanced Materials: CNR Rao, Rsc Publication.
6. Materials Science and Engineering an Introduction, William D. Callister, (Jr. Wiley publisher).
7. Introduction to nano materials by T.Pradeep.

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16EE C 01

ELEMENTS OF ELECTRICAL ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. To understand the basic concepts of electrical circuits.
2. To understand the principles of electromagnetic induction.
3. To know about different types of batteries, charging and discharging of batteries and types of fuel cells etc.
4. To know about different types of electrical wires and cables, domestic and industrial wiring.
5. To understand safety rules and methods of earthing.

Course Outcomes: After completion of the course, the student will be able to:
1. Acquire the knowledge of basic concepts of electrical circuits such as Ohm's law, Kirchhorff's laws etc.
2. Acquire the knowledge of basic Faraday's laws of electromagnetic induction.
3. Acquire the knowledge to solve the problem of AC circuits.
4. Acquire the knowledge of specifications of batteries, types of cells and sources of renewable energy.
5. Acquire the knowledge of electrical wiring and cables and their types and electrical equipment and their specification.
6. Acquire the knowledge of safety precautions in handling electrical appliances, importance of grounding and methods of earthing.

UNIT-I DC Circuits
Current, voltage, power and energy, sources of electrical energy, independent and dependent sources, source conversion, circuit elements, Resistor, Inductor, Capacitor Ohm's law, Kirchhoff's laws, analysis of series, parallel and series-parallel circuits, star-delta conversion, Node and Mesh analysis (with independent sources only).

UNIT-II : Electromagnetism & AC Circuits Electric charge, electric field, lines of force, electric field intensity, electric flux and flux density, Faraday's laws of electromagnetic induction, static and dynamically induced EMF.
A.C. Circuits: Generation of alternating voltage and current, equation of alternating voltage and current, average and rms values of sinusoidal quantities, form and peak factors, phasor representation of sinusoidal quantities, AC through pure resistance pure Inductance, pure capacitance, RL,RC,RLC circuits.

UNIT-III: Batteries and Fuel Cell
Introduction to batteries, simple cell, EMF and internal resistance of a cell, primary and secondary cells, cell capacity, types and specifications of batteries, charging and discharging of battery, safe disposal of batteries; fuel cell, principle and types of fuel cell, different sources of renewable energy.

UNIT-IV: Electrical Wiring
Types of wires and cables, types of connectors and switches, system of wiring, domestic and industrial wiring, simple control circuit in domestic installation, electrical equipment and their specifications

UNIT-V: **Safety & Protection**
Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, other electrics hazards, safety rules, importance of grounding and earthing of electrical equipment, methods of earthing, circuit protection devices: Fuses, MCB, ELCB and Relays.

Text Books:
1. Edward Hughes, "Electrical and Electronics Technology", 10th Edition, Peasson Publishers 2010.
2. V.K. Mehta & Rohit Mehta, "Principles of Electrical Engineering", S.Chand Company Limited 2008
3. B.L. Theraja & A.K. Theraja, "Electrical Technology", Vol.I, S.Chand Company Limited 2008.

Suggested Reading:
1. P.V.Prasad & S. Siva Nagraju, "Electrical Engineering: Concepts & Applications", Cengage Learning, 2012.
2. S. Rao, "Electrical Safety, fire safety engineering & Safety Management", Khanna publications, 1998.
3. Surjit singh & Ravi Deep Singh, "Electrical Estimating and Costing", Dhanapath Rai & Co., 1997.

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16CE C01

ENGINEERING MECHANICS

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives: During this course, students should develop the ability to:

1. Work comfortably with basic engineering mechanics concepts required for analyzing static structures
2. Identify an appropriate structural system to study a given problem and isolate it from its environment.
3. Analyze and model the problem using free-body diagrams and equilibrium equations
4. Apply pertinent principles to the system to solve and analyze the problems subjected to frictional forces.
5. Understand the meaning of centroid/ centers of gravity and moments of Inertia using integration methods.
6. Communicate the solution to all problems in an organized and coherent manner and elucidate the meaning of the solution in the context of the problem.

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

1. Solve problems dealing with forces in planar force systems
2. Draw free body diagrams to analyze the forces in the given structure
3. Understand the concept of moments and couples in plane systems.
4. Understand the mechanism of friction and can solve friction problems
5. Determine the centroid of plane areas and centers of gravity of bodies using integration methods
6. Determine moments of inertia, product of inertia for all areas and mass moments of inertia for bodies,

Unit - I

Force Systems: Resolution of coplanar and non-coplanar force systems (both concurrent and non-concurrent), Determining the resultant of planar force systems. Moment of force and its applications and couples

Unit – II

Equilibrium of force system: Free body diagrams, equations of equilibrium of planar force systems and its applications. Problems on general case of force systems

Unit – III

Theory of friction: Introduction, types of friction, laws of friction, application of friction to a single body & connecting systems. Wedge and belt friction

Unit – IV

Centroid: Significance of centroid, moment of area, centroid of line elements, plane areas, composite areas, theorems of Pappus & its applications. Center of gravity for elementary and composite bodies

Unit – V

Moment of Inertia: Definition of MI, Polar Moment of Inertia, radius of gyration, transfer theorem, moment of Inertia of elementary & composite areas, product of inertia. Mass moments of inertia for elementary and composite bodies

Text Books:

1. K. Vijay Kumar Reddy and J. Suresh Kumar, Singer's Engineering Mechanics, BS Publications, Hyderabad, 2011.
2. Ferdinand L Singer, Engineering Mechanics, Harper and Collins, Singapore, 1904.

Suggested Reading:

1. A. Nelson, Engineering Mechanics, Tata McGraw Hill, New Delhi, 2010.
2. S. Rajashekaran & G. Sankarasubramanyam, Engineering Mechanics, Vikas publications, Hyderabad, 2002.
3. S.B. Junarkar and H.J Shah, Applied Mechanics, Charotar publishers, New Delhi, 2001.
4. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press, New Delhi, 2008.
5. A K Tayal, Engineering Mechanics, Umesh Publications, New Delhi, 2010

16EG C01

PROFESSIONAL COMMUNICATION IN ENGLISH

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To enable the students to understand the role and importance of communication and to develop their basic communication skills in English.
2. To strengthen the students' usage of grammar and to develop their vocabulary.
3. To improve the students' listening skills and introduce them to different reading strategies.
4. To equip the students with appropriate writing skills.
5. To enhance imaginative and critical thinking through literary texts and book review.

Course Outcomes: The students will

1. Understand the nature, process and types of communication and will communicate effectively without barriers.
2. Understand the nuances of listening and will learn to make notes
3. Read different texts, comprehend and draw inferences and conclusions.
4. Write effective paragraphs, letters and reports
5. Critically analyze texts and write book reviews

UNIT- I Understanding Communication in English: Introduction, nature and importance of communication. Process of communication. Basic types of communication - verbal and non verbal. One way vs. Two way communication. Barriers to communication. Intrapersonal and interpersonal communication. Johari Window.
Grammar & Vocabulary: Parts of speech, figures of speech – Euphemism, Hyperbole, Irony, Metaphor, Onomatopoeia, Oxymoron, Paradox, Personification, Pun & Simile

UNIT- II Developing Listening Skills: Exposure to recorded and structured talks, class room lectures- problems in comprehension and retention. Types of listening, barriers to listening, effective listening strategies. Note –taking.
Grammar & Vocabulary: Articles, Prepositions, Phrasal verbs, Idioms.

UNIT- III Developing Writing Skills: Sentence structure. Brevity and clarity in writing. Cohesion and coherence. Paragraph writing. Letter writing - form and structure, style and tone. Kinds of Letters –Apology and request letters. Email etiquette. Report writing.
Grammar & Vocabulary: Tense, Conditionals, homonyms, homophones.

UNIT - IV Developing Reading Skills: The reading process, purpose, different kinds of texts. Reading comprehension. Techniques of comprehension – skimming, scanning, drawing inferences and conclusions. Note-making
Grammar &Vocabulary: Concord, Connectives, Active and Passive voice, Words often confused.

UNIT- V: Reading for Enrichment

1.	The Road Not Taken	Robert Frost
2.	Goodbye Party For Miss Pushpa T. S	Nissim Ezekiel
3.	The Open Window	Saki
4.	The Romance Of A Busy Broker	O. Henry

Book reviews -Oral and written review of a chosen / novel/ play - a brief written analysis including summary and appreciation. Oral presentation of the novel/play
Grammar & Vocabulary: Indianisms, Common errors, Parallelisms.

Text Books:

1. Vibrant English, Orient Blackswan Ltd,

Suggested Reading:

1. M .Ashraf Rizvi, Effective Technical Communication, Tata Mc Graw- Hill, New Delhi
2. Meenakshi Raman and Sangeetha Sharma, Technical Communication - Principles and Practice, Oxford Univ. Press, New Delhi.
3. Sunil Solomon, English for Success, Oxford University Press, 2015
4. Krishna Mohan, Meera Banerji, Developing Communication Skills, McMillan India Ltd.
5. Michael McCarthy, English Vocabulary in Use.
6. Brikram K Das, Kalyani Samantray, An Introduction to Professional English and Soft Skills Cambridge University Press, New Delhi.

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16CE C02

ENVIRONMENTAL STUDIES

Instruction	1L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	- - -
Credits	1

Course Objectives:
1. To equip the students with inputs on the environment, natural resources and their conservation.
2. To study the interrelationship between the living organisms and the natural environment and also to enable the students to understand the structure and functioning of the ecosystems.
3. To understand the importance of biodiversity and create awareness on its threats and conservation strategies.
4. To enable the students become aware of pollution of various environmental segments including their causes, effects and control measures.
5. To create awareness about environmental legislations in the context of national conventions.

Course Outcomes: At the end of the course, the student should have learnt
1. To understand the scope and importance of environmental studies, identify the natural resources and ecosystems and contribute for their conservation.
2. To understand the ecological services of biodiversity and contribute for their conservation.
3. To develop skills to solve the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
4. To relate the social issues and the environment and contribute for the sustainable development.
5. To understand the essence of the ethical values of the environment for conserving depletable resources and pollution control.

UNIT – I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Water resources- hydrological cycle, use and over utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Food resources- Changes caused by modern agriculture, fertilizers-pesticide problems, water logging and salinity. Forest resources- use and over exploitation, deforestation. Mineral resources- Use and exploitation, effects of mining. Energy resources- Growing energy needs, various renewable and non-renewable energy sources. Land resources- land as a resource, land degradation- causes and effects, Role of individuals in conservation of natural resources.

UNIT – II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, concept of food chains, food webs, ecological pyramids.

UNIT – III

Biodiversity: Types/classification of biodiversity, India as a mega diversity nation, values of biodiversity, threats to biodiversity, Conservation of biodiversity.

UNIT – IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, Soil pollution, Noise pollution and Thermal pollution.

Environmental Legislations: Environment protection act, Air, Water, Forest & Wild life acts.

UNIT – V

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development, Population explosion and Climate change: Global warming, Acid rain, Ozone layer depletion.

Text Books:
1. P. D.Sharma, "Ecology & Environment", Ashish publications, 1994
2. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004

Suggested Reading:
1. Dr. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria & Sons, 2009
2. C. S. Rao, "Environmental Pollution Control Engineering", Wiley, 1991
3. S. S. Dara, "A Text Book of Enviromental Chemistry & Polution Control", S. Chand Limited, 2006

16ME C02

ENGINEERING GRAPHICS

Instruction	1L + 3D Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To provide an exposure in understanding the drawings during a multidisciplinary approach towards a problem
2. To train up in perception and imagination of a three dimensional scenario.

Course Outcomes:

1. To understand theory of projections
2. Ability to improve visualization skills
3. Ability to sketch Engineering Objects

UNIT – I

Introduction to Engineering Drawing: Drawing Instruments and their uses, types of lines, use of pencils, Lettering, Rules of dimensioning

Conic Sections: Ellipse, Parabola, Hyperbola including the Rectangular Hyperbola (General method only)

Cycloidal curves: Construction of cycloid, epi-cycloid, hypo-cycloid & involutes

UNIT – II

Orthographic Projections: Principles of Orthographic Projections – Conventions , Projection of Points, Projection of Lines - inclined to both planes.

UNIT – III

Projections of Planes: Projections of regular Planes – Perpendicular planes and Oblique planes.

UNIT – IV

Projections of Solids: Projections of Regular Solids – Regular Polyhedra, solids of revolution, (Simple position only)

Sections of Solids: Types of cutting planes – their representation – sections of solids in simple position.

UNIT – V

Introduction to Graphic packages: Getting started, Basic drawing and editing commands, creating lines, planes and solids.

Note: Syllabus for external examination will be from unit 1 to unit 4 only & unit-5 is exempted from external examination. Unit 5 is for internal examination only.

Text Books:

1. N.D.Bhatt," Elementary Engineering Drawing", Charotar Publishers, 2012
2. Basanth Agrawal and C M Agrawal "Engineering Drawing 2e ", McGraw-Hill Education(India) Pvt. Ltd.

Suggested Reading:

1. K.L.Narayana and P.K.Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011
2. P.S.Gill' "Engineering Graphics", Kataria Publications, 2011
3. K.Veenugopal, "Engineering Drawing and Graphics + Autocad", New Age International Pvt. Ltd, 2011
4. Shaw M.B and Rana B.C., "Engineering drawing", Pearson, 2nd edition, 2009
5. P I Varghees, " Engineering Graphics ",Tata McGraw-Hill publications, 2013
6. Bhattacharya. B, "Engineering Graphics", I. K. International Pvt. Ltd, 2009
7. Dhawan R.K., "Principles of Engineering Graphics and Drawing", S. Chand, 2011

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16PY C03

ENGINEERING PHYSICS LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

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

1. Apply theoretical physics knowledge in doing experiments
2. Understand the behavior of the light experimentally
3. Analyze the behavior of magnetic and dielectric materials

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

1. Understand the concept of errors and find the ways to minimize the errors
2. Demonstrate interference and diffraction phenomena experimentally
3. Distinguish between polarized and unpolarized light
4. Determine the loss of energy of a ferromagnetic material and its uses in electrical engineering
5. Understand the suitability of dielectric materials in engineering applications

List of 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 mercury light
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. B-H Curve – Determination of hysteresis loss of given specimen
9. Dielectric Constant – Determination of dielectric constant of given PZT sample
10. Ultrasonic Interferometer – Determination of velocity of ultrasonics in given liquid

Note: A student must perform a minimum of eight experiments.

Suggested Reading:

1. "Engineering Physics" - Manual by Department of Physics, CBIT, 2016
2. S.K. Gupta, "Engineering Physics Practical", Krishna's Educational Publishers, 2014
3. O.P. Singh, V. Kumar and R.P. Singh, "Engineering Physics Practical Manual", Ram Prasad & Sons Publications, 2009

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16CY C04

APPLIED CHEMISTRY LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives:

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory
2. For practical understanding of theoretical concept of chemistry.
3. The student should be conversant with the principles water characterization and treatment of potable and industrial purposes.

Course Outcomes:

1. This syllabus helps the student to understand importance of analytical instrumentation for different chemical analysis.
2. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.

LIST OF EXPERIMENTS

1. Introduction to chemical analysis
2. Preparation of standard solution of oxalic acid and Standardization of NaOH
3. Estimation of amount of oxalic acid in the given solution using Mohr's salt and $KMnO_4$
4. Estimation of total hardness of water using EDTA solution
5. Estimation of temporary hardness and permanent hardness of water using EDTA solution
6. Estimation of amount of carbonate in the given solution using HCl link solution
7. Estimation of amount of carbonate and bicarbonate in the given solution using HCl link solution
8. Estimation of amount of HCl conductometerically using NaOH solution
9. Estimation of amount of CH_3COOH conductometerically using NaOH solution
10. Estimation of amount of HCl and CH_3COOH present in the mixture of acids conductometerically using NaOH solution
11. Estimation of amount of HCl potentiometrically using NaOH solution
12. Estimation of amount of Fe^{+2} potentiometrically using $KMnO_4$ solution

Suggested Reading:

1. Applied Chemistry: Theory and Practice (Latest ed.), By O.P. Vermani & A.K. Narula
2. Vogel's Textbook of Quantitative Chemical Analysis (Latest ed.), Revised by G.H. Jeffery, J. Bassett, J. Mendham & R.C. Denney
3. Instrumental methods of Chemical Analysis, MERITT & WILLARD East-West Press

16EG C02

PROFESSIONAL COMMUNICATION LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives:

1. To introduce students to phonetics and the different sounds in English.
2. To familiarize the students with the software and give them sufficient practice in correct pronunciation.
3. To enable students to speak English correctly with focus on stress and intonation.
4. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
5. To understand team work, role behavior and to develop the ability to analyze, evaluate, construct and refute arguments.

Course Outcomes:

1. The students will understand the speech sounds in English and the nuances of pronunciation.
2. The students will understand tone, intonation and rhythm and apply stress correctly.
3. The students will be able to participate in group discussions with clarity and confidence.
4. The students will speak confidently on stage with appropriate body language.
5. The students will debate on various issues and learn to work in teams.

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. **Aspects of connected speech**: Strong forms, weak forms, contracted forms, elision.
4. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
5. **Rhythm & Intonation**: Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
6. **Listening skills** – practice with IELTS and TOEFL material
7. **Situational dialogues and role play**
8. **Public speaking** is to be shown by incorporating narrative examples and extracts from speeches.
9. **Group Discussions**– videos to be shown and practice sessions
10. **Poster making** – preparation and presentation
11. **Debate -** Differences between a debate and a group discussion. Essentials of a debate, conducting a debate.

Suggested Reading:

1. E Suresh kumar et al, . English for Success (with CD), Cambridge University Press India Pvt Ltd. 2010.
2. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016
3. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
4. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
5. Edgar Thorpe. Winning at Interviews, Pearson Education, 2006
6. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd 2011

16 MT C02

ENGINEERING MATHEMATICS – II

Instruction	3L Periods per week + 1 (extra hour)
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To know the relevant methods to solve higher order differential equations.
2. To learn the Laplace and Inverse Laplace transforms for solving engineering problems.
3. To know improper integrals such as Beta, Gamma functions.
4. To learn Vector Differential Operator and its physical interpretations.
5. To evaluate vector line, surface & volume integrals.
6. Learn to apply all the above mathematical methods/techniques to interpret the results in physical and technical terms.

Course Outcomes:

1. Solve the solutions of Differential Equations which arise in electrical circuits, vibrations and other linear systems.
2. Able to solve solutions of differential equations with initial and boundary value problems.
3. Evaluating definite integrals using Beta, Gamma functions.
4. Understating the significance of gradient, divergent and Curl.
5. Use Greens, Gauss and Stoke's theorems to find the surface and volume integrals.
6. Able to solve and analyse the Engineering problems.

UNIT-I Ordinary differential Equations: Linear Differential equations of higher order with constant coefficients, complementary function and particular integrals when RHS is of the forms $e^{ax}, \sin ax, \cos ax, x^m, e^{ax}(v), x^m(v)$,where v-is a function of x, Cauchy's equation, electrical circuits of second order

UNIT-II Laplace Transforms: Laplace transforms of standard functions, Laplace transforms of piecewise continuous functions, first shifting theorem, multiplication by 't', division by 't'. Laplace transforms of derivatives and integrals of functions-Unit step function- Periodic functions (without proofs). Inverse Laplace transforms-by partial fractions (Heaviside method), Convolution Theorem, Solving Ordinary differential equations by Laplace Transforms

UNIT-III Beta and Gamma Functions: Definitions of Beta and Gamma functions-elementary Properties of both Beta and Gamma functions, Relation between Beta and gamma functions, differentiation under the integral sign.

UNIT-IV Vector Differentiation: Scalar and vector fields- directional derivative- Gradient of a scalar-Divergence and Curl of a vector point function. Properties of divergence, curl, Solenoidal and Irrotational vectors

UNIT-V Vector Integration: Evaluation of Vector Line integrals, surface integrals and volume integrals, Greens, Gauss divergence and Stokes theorems (without proofs) and its applications

Text Books:

1. Erwin Kreyszig "Advanced Engineering Mathematics,"10th edition, John Wiley & Sons -Publishers.
2. R.K.Jain & S.R.K.Iyenger "Advanced Engineering Mathematics" , 3rd edition, Narosa Publications
3. Alen Jaffery "Mathematics for Engineers & Scientists" , 6th ed 2013 CRC press, Taylor & Francis Group. (Elsevier)
4. Dr.B.S.Grewal "Higher Engineering Mathematics", 43rd edition, Khanna Publishers.

Suggested Reading: (for further reading and examples on applications)

1. A.Craft and Robert Davison "Mathematics for Engineers-a modern interactive approach" -Willey
2. Loius Pipes "Applied Mathematics and physicists" Mc Graw Hill publishers.
3. Kanti.B.Datta "Mathematical Methods of Science & Engg," Aided with MATLAB,. Cengage Learning India Pvt.Ltd.
4. AR Collar and A. Simpson "Matrices for Engineering Dynamics" -John Willey & sons.

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16CY C01

ENGINEERING CHEMISTRY

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

The syllabus has sought to fulfil the objective of making the student of engineering and technology realize that chemistry is the real base of his profession and that therefore he must have a good understanding of chemistry before he can use it in his profession.

“ the study of chemistry is profitable not only in as much as it promotes the material interest of mankind ,but also because it furnishes us with insight into the wonders of creation , which immediately surround us and with which our existence, life and development, are most closely connected.” ----- Justus Von Leibig (German Chemist)

The various units of the syllabus is so designed to fulfil the following objectives.

1. This syllabus helps at providing the necessary introduction of the chemical principles involved and devices in a comprehensive manner understandable to the students aspiring to become practicing engineers.
2. The aim of framing the syllabus is to impart intensive and extensive knowledge of the subject so that students can understand the role of chemistry in the field of engineering.
3. Thermodynamics and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. Fuels have been taught with a view to give awareness as to materials which can be used as sources of energy
5. To understand importance of analytical instrumentation for different chemical analysis.

Course Outcomes:

1. This syllabus gives necessary theoretical aspects required for understanding intricacies of the subject and also gives sufficient exposure to the chemistry aspects in different disciplines of engineering
2. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.
3. This syllabus imparts a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

UNIT – I

Chemical Thermodynamics: Introduction and definition of the terms, the concept of reversible and irreversible processes, Work done in isothermal and adiabatic processes, Success and limitations of First law of thermodynamics, need for second law of thermodynamics, statements of second law of thermodynamics, Carnot cycle, heat engine and its efficiency, Carnot theorem, concept of Entropy - Entropy changes in reversible and irreversible processes, physical significance of entropy criteria of spontaneity in terms of entropy and Gibb’s free energy function , Gibb’s-Helmholtz equation and applications, Numericals.

UNIT – II

Phase rule & Chemical Equilibria

Phase rule : Statement , definition of the terms - phases, components , degrees of freedom with examples, Phase diagram - one component system (water system), two component system (siver-lead system) , desilverisation of lead.

Chemical Equilibria - Homogenous and Heterogenous Equilibria - applications

UNIT – III

Fuels: Classification, requirements of a good fuel, calorific value, types of calorific value, calculation of CV using Dulong’s formula, Combustion - calculation of air quantities by weight and volume, Numericals.

Solid fuels: coal - analysis of coal – proximate and ultimate analysis - importance.

Liquid fuels - crude oil - fractional distillation, cracking - Fixed bed catalytic cracking, knocking, antiknocking agents (TEL, MTBE), octane number, cetane number, unleaded petrol.

Gaseous fuels - LPG, CNG - composition and uses

UNIT – IV

Electrochemistry Introduction, construction of electrochemical cell, sign convention, cell notation, cell emf, SOP and SRP, electrochemical series and its applications, Nernst equation and applications, Types of Electrodes - Standard Hydrogen Electrode, Saturated Calomel Electrode, Quinhydrone electrode and Ion selective electrode (Glass electrode), construction, Numericals

UNIT –V

Instrumental Techniques in Chemical Analysis: Principle, method and applications of Conductometry (acid-base titration), Potentiometry (acid-base, redox titration), pH- metry (acid – base titration), Colorimetry (Beer Lambert’s law)

Green Chemistry - outlines and Principles

Text Books:

1. P.C.Jain and Monica Jain, “Engineering Chemistry”, Dhanpat Rai Pub, Co., New Delhi (2002)
2. Puri & Sharma, “Principles of Physical Chemistry
3. S.S.Dara & S.S.Umare, “Engineering Chemistry”, S.Chand company
4. J.C. Kuriacase & J. Rajaram, “Chemistry in engineering and Technology”, Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
5. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
6. P.R.Vijayasarathi, “Engineering Chemistry” PHI Learning Private Limited, New Delhi (2011)

Suggested Reading:

1. Physical chemistry by P.W.Atkin (ELBS OXFORD PRESS)
2. Physical chemistry by W.J.Moore (Orient Longman)
3. Physical Chemistry by Glasstone
4. Physical Chemistry by T.Engel & Philip Reid, Pearson Publication.
5. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd.,Meerut (2001).

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16PY C02

APPLIED PHYSICS

Instruction	2L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	20 Marks
Credits	2

Course Objectives: The objectives of the course is to make the student
1. Learn the concepts of modern physics
2. Gain knowledge of wave mechanics and statistical mechanics
3. Know the different kinds of materials and their characterization techniques

Course Outcomes: At the end of the course, the student will be able to
1. Understand the advances in laser physics, holography, optical fibers and apply them in engineering & technology
2. Explain the importance of wave mechanics and band theory of solids
3. Analyze and apply distributions of statistical mechanics for problem solving
4. Identify the materials with semiconducting and superconducting properties for engineering applications
5. Understand the role of novel materials and their characterization techniques in engineering and technology

UNIT – I Lasers & Holography: Characteristics of lasers – Spontaneous & stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – He-Ne laser – Semiconductor laser – Applications. Basic principle of Holography – Recording & Reconstruction of hologram – Applications
Optical Fibers: Principle and Construction – Propagation of light through an optical fibre – Acceptance angle – Numerical aperture – Pulse dispersion – Classification of optical fibers: Single mode & Multi mode and Step-index & Graded-index optical fibers – Double crucible method – Applications.

UNIT – II Wave Mechanics: Schrödinger time independent and time dependent wave equations – Physical significance of wave function – Infinite square well potential (particle in a box) – Potential barrier – Tunneling effect .
Band Theory of Solids: Origin of energy band formation – Electron in periodic potential – Kronig-Penny model (qualitative) – Classification of solids

UNIT – III Elements of Statistical Mechanics: Maxwell-Boltzmann statistics – Bose-Einstein statistics – Fermi-Dirac statistics – Photon gas – Planck's' law of black body radiation – Wien's law and Rayleigh-Jean's law from Planck's law – Concept of electron gas (qualitative) – Fermi energy level.

UNIT – IV Semiconductors: Intrinsic and extrinsic semiconductors – Carrier concentration in intrinsic semiconductors – Energy gap – Hall Effect – Construction & working of solar cell.
Superconductors: General properties of superconductors – Meissner's effect – Type I and Type II superconductors – BCS theory (qualitative) – Applications.

UNIT – V Nanomaterials: Properties of materials at reduced size – Surface to volume ratio – Quantum confinement –Preparation of nanomaterials: Bottom-up approach (Sol-gel method) & Top-down approach (Ball milling method) – Elementary ideas of carbon nanotubes – Applications of nanomaterials.
Techniques for Characterization of Materials: X-ray fluorescence – Auger (OJ) process – Scanning electron microscope (SEM) – Tunneling electron microscope (TEM) – Atomic force microscope (AFM).

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 Engineering Physics", S. Chand Publications, 2014.
3. Satya Prakash, "Statistical Mechanics", Kedar Nath Ram Nath Publications, 2008.
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. M. Arumugam, "Materials Science", Anuradha Publications, 2015.
3. P.K. Palanisamy, "Engineering Physics", Scitech Publications, 2012.
4. Hitendra K Malik and A.K. Singh, "Engineering Physics", Tata McGraw Hill Education Publications, 2011

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16CS C01

PROGRAMMING AND PROBLEM SOLVING

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

Course Objectives:
1. To acquire problem solving Skills.
2. To be able to write Algorithms.
3. To understand structured programming Approach.
4. To understand Memory structure.
5. To implement I/O Programming.
6. To be able to write program in C Language.

Course Outcomes: Student will be able to:
1. Develop algorithms for scientific problems.
2. Explore algorithmic approaches to problem solving.
3. Understand the components of computing systems.
4. Choose data types and structure to solve mathematical problem.
5. Develop modular programs using control structure, arrays and structures.
6. Write programs to solve real world problems using structured features.

UNIT – I

Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts.

Introduction to C Language: Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

UNIT – II

Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do-While and Examples. Continue, Break and goto statements.

Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Parameter Passing-Call-by-value, call-by-reference, Recursion**.**

UNIT – III

Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.

Arrays: Concepts, Using Arrays in C, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays.

Searching and Sorting: Linear and Binary Search, Selection Sort and Bubble Sort.

UNIT – IV

Pointers: Introduction, Pointers to Pointers, Compatibility, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command-line Arguments.

Strings: Concepts, String Input /Output Functions, Arrays of Strings, String Manipulation Functions.

UNIT – V

Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Unions, Type Definition (typedef), Enumerated Types.

Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/output Functions, Character Input/output Functions

Preprocessors: Preprocessor Commands

Text Books:
1. Pradip Dey and Manas Ghosh “Programming in C 2/e” Oxford University Press , 2nd Edition 2011.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language” Prentice Hall India, 2nd Edition. 1990.
3. B.A.Forouzan and R.F. Gilberg A Structured Programming Approach in C, Cengage Learning,2007.

Suggested Reading:
1. Rajaraman V. "The Fundamentals of Computers" 4th Edition, Prentice Hall of India, 2006.
2. R S Bichker “programming in c” University Press ,2012.

16ME C01

ELEMENTS OF MECHANICAL ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. Student will understand different types of engineering materials and their applications.
2. Student will come to know working principles of Petrol & Diesel engines with basic knowledge of thermodynamics.
3. Student will understand various making processes.
4. Student will come to know various power transmission devices.
5. Student will understand the importance of principles of management in industry.
6. Student will come to know aspects of various quality control techniques.

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

1. Select the material depending upon requirement.
2. Evaluate performance of Petrol & Diesel engines.
3. Demonstrate his/her knowledge in preparing process chart for various machining operations.
4. Estimate the power required for various power transmitting devices like belt and gear trains.
5. Become a successful entrepreneur after studying principles of management.
6. Apply various quality control techniques after studying principles of industrial engineering.

UNIT – I Engineering Materials: Metals and their alloys, Ductile and brittle materials, Ceramics, Polymers, Composite materials
Simple Stresses & Strains: Stress-strain diagram (for ductile and brittle materials), Poison's ratio, Young's Modulus, Rigidity modulus, Bulk modulus, Failure theories, factor of safety.

UNIT – II Thermodynamics: Zeroth, First, Second and Third laws of thermodynamics and corollaries
I.C. Engines: Working principle of Two stroke and Four stroke SI and CI engines, Calculations of efficiencies
Heat Transfer: Fourier law of conduction in single coordinates, Newton's law of conduction, Stephens & Boltzmann law of radiation

UNIT – III Basic Manufacturing Processes: Introduction to Welding, Brazing & Soldering, Principles of gas welding & arc welding processes, Casting, Principles of sand casting and die casting, Principles of Turning, Drilling, Milling, Grinding, Knurling, Tapping and Honing operations

UNIT – IV Kinematics: Definitions of kinematic link, pair, mechanism and machine
Gear Trains: Simple, Compound, Inverted and Epicyclic gear trains
Belt Drives: Open and crossed belt drives, length of belts, ratio of belt tensions for flat belt, condition for maximum power transmission for flat belt
Fluid Mechanics: Definition and basic properties of fluids, types of fluids and fluid flows, stream lines, streak lines, stream function and velocity potential

UNIT – V Industrial Engineering & Management: Introduction to scientific management, basics and importance of work study, steps in conducting work study, time study, standard time, organization and types of organization, Quality definition and its importance, introduction to quality control, types of inspection.

Text Books:

1. Jonathan Wickert and Kemper E. Lewis, An Introduction to Mechanical Engineering,3rd Ed, Cengage learning, USA, 2013
2. Yunus A. Cengel, Heat Transfer: A Practical Approach, Mcgraw-Hill, 2nd edition, 2002
3. Mahesh M Rathore, Thermal Engineering, Tata Mc Grw Hill Eduation Pvt. Ltd., 2010

Suggested Reading:

1. R K Rajput, Thermal Engineering, Laxmi Publications, 2010
2. Michael Geoffrey Stevenson, Industrial Engineering, University of N.S.W., Division of Postgraduate Extension Studies, 1972
3. PN Rao, Manufacturing Technology, Volume-I, 3rd Edition, Tata McGraw-Hill, Education, 2009
4. Thomas Bevan, Theory of Machines, 3rd Edition, Pearson Education India, 1986
5. P. N. Modi, S. M. Seth, Hydraulics and Fluid Mechanics: Including Hydraulic Machines, Standard Book House, 2011

16EC C01

ELEMENTS OF ELECTRONICS AND COMMUNICATION ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. To understand the elementary concepts of electronic devices.
2. To study basics of Boolean algebra and working of digital circuits.
3. To understand basic operations of AM, FM, filters and multiplexing .
4. To enable the students to understand the working of commonly used communication systems.
5. To give an exposure to the selected applications.

Course Outcomes: The students will be able to
1. Familiar with the basic electronic devices and simple circuits
2. Work with Boolean algebra principles, build the simple combinational and sequential circuits
3. Appreciate the need for modulation, filtering and multiplexing
4. Understand the working principles of a few communication systems
5. Familiar to the selected applications

UNIT – I
Basics of Passive and Active Devices
Classification of passive and active devices and their symbols; current flow in a semiconductor; Operating principle of a diode, its application as a rectifier; Operating principle of a transistor (BJT and JFET), Principle and use of Zener diode, Photo diode and LED.

UNIT-II
Introduction to Digital Electronics
Number systems, Binary addition and subtraction, ASCII code, Boolean algebra (Theorems and properties), Logic gates, Combinational circuits such as Half adder, Full adder and Half subtractor, Introduction to sequential logic, Basic Flip flop, Evolution of ICs, block diagram description of Microprocessor and Microcontroller.

UNIT – III
Principles of Communication Engineering (Elementary treatment only)
Basic Communication system components; Concept of Modulation, Introduction to AM, FM and comparisons; Introduction to wired and wireless communication; Concepts of filtering, LPF, HPF, BPF and BSF; concept of multiplexing, TDM and FDM.

UNIT-IV
Overview of Communication Systems
Radio spectrum and applications, Modes of propagation;
Basic cellular network and concepts of a cell, frequency reuse, hand-off and cross-talk;
Basic Radar block diagram and applications; Introduction to communication satellite, Geostationary satellites and subsystems, Applications of satellites, GPS, DTH, Remote Sensing;

UNIT –V
Basic operating principles of selected applications:
Block diagram of CRO and application; Software Defined Radio (SDR)-Definition and it's block diagram; Smart phone-features; Introduction to Wireless sensor networks (Bluetooth and ZigBee), RFID-and its types, basic functions; Introduction to Modem.

Text Books:
1. "Electronic Principles" by Albert Malvino and David J Bates, 7th Edition, 2006
2. "Digital Priniciples and Applications", by Donald P Leach, Albert Paul Malvino, Gautham saha, Tata McGraw Hill,6th Edition,2009
3. "Electronic Communication Systems", by Kennedy and Davis, Tata Megra Hill Publications, 4th Edition, 2008

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16CE C03

PROFESSIONAL ETHICS AND HUMAN VALUES

Instruction	1L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	- - -
Credits	1

Course Objectives:
1. To develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. To enable the students, understand the values, the need for value adoption and prepare them meet the challenges
3. To enable the students, develop the potential to adopt values, develop a good character and personality and lead a happy life
4. To motivate the students, practice the values in life and contribute for the society around them and for the development of the institutions /organisation around they are in.
5. To make the students understand the professional ethics and their applications to engineering profession

Course Outcomes:
1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, convert everything into happiness and contribute for the happiness of others.
4. Students become potential sources for contributing to the development of the society around them and institutions/ organisations they work in.
5. Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

UNIT-I Concepts and Classification of Values –Need and challenges for value Adoption -Definition of Values – Concept of Values – Classification of Values – Hierarchy of Values – Types of Values – Interdependence of Values
Need for value education – Lack of education in values – Benefits of value education- Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges

UNIT – II: Personal Development and Values in Life
Personal Development: – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity - Integrating values in everyday life

UNIT – III: Practicing Values for the development of Society
Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atrocities – Working for the Sustainable development of the society
Principles of Integrity-Institutional Development - Vision for better India.

UNIT – IV: Basic Concepts of Professional Ethics
Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional Ethics, Ethical dilemmas, Science – Religion - Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities like Sri.M.Visweshwarayya, Dr.APJ Abdul Kalam and JRD Tata

UNIT-V: Ethics in Engineering Profession
Engineering Profession-Technology and Society- Ethical obligations of Engineering Professionals-Role and responsibility of Engineers - A few Case Studies on Risk management safety and Risk Management
Plagiarism-Self plagiarism- -Ethics Standards and Bench Marking

Text Books:

1. Subramanian R, “ Professional Ethics “ , Oxford University Press , 2013
2. Nagarajan R S, “ A Text Book on Human Values and Professional Ethics “ New Age Publications , 2007
3. Dinesh Babu S, “ Professional Ethics and Human Values “ , Laxmi Publications , 2007

Suggested Reading:

1. SantoshAjmera and Nanda Kishore Reddy , “Ethics , Integrity and Aptitude”,McGrawhill Education Private Limited, 2014
2. Govinda Rajan M, Natarajan S, Senthil Kumar V S,“Professional Ethics and Human Values”, Prentice Hall India, Private Limited,2012
3. Course Material for Post Graduate Diploma In “Value Education & Spirituality” Prepared by Annamalai University in Collaboration with Brahma Kumaris, 2010

16CS C02

PROGRAMMING LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

1. Demonstration of control structures.
2. Demonstration of switch case (menu driven).
3. Demonstration of Parameter passing Methods.
4. Demonstration of Functions using Recursion.
5. Demonstration of arrays Operations on Matrix.
6. Implementation of bubble sort.
7. Implementation of selection sort.
8. Implementation of Linear and Binary Search.
9. Implementation of string manipulation operations with and without library function.
10. Demonstration using Pointers.
11. Demonstration of Array of Structures.
12. Sequential file operations.

Text Books:

1. Pradip Dey and Manas Ghosh “Programming in C 2/e” Oxford University Press , 2^{nd} Edition 2011.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language” Prentice Hall India, 2^{nd} Edition. 1990.

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16ME C03

MECHANICAL AND IT WORKSHOP

Instruction	3P Periods per week
Duration of End Examination	3 Hours
End Examination	50 Marks
Sessional	25 Marks
Credits	2

Mechanical Workshop

Trades for Practice 1. Fitting 2. Tin Smithy 3. Carpentry 4. House Wiring Exercises in Fitting

1. To make a perfect rectangular MS flat
2. To do parallel cuts using Hack saw
3. To drill a hole and tap it
4. To make male and female fitting using MS flats-Assembly1
5. To make male and female fitting using MS flats-Assembly2

Exercises in Tin smithy

1. To make a square tray from the given sheet metal.
2. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
3. To make a scoop.
4. To make a dust pan from the given sheet metal.
5. To make a pamphlet box.

Exercises in Carpentry

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

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

Demonstration of plumbing and welding trades

Note: ***A minimum of 12 exercises from the above need to be done***

Suggested Reading:

1. Workshop Technology -- Hazra chowdary

IT Workshop

List of Tasks:

Task 1: MS Word: Formatting text, inserting images, tables, equations and hyperlinks
Document Management: Page layout techniques and printing
Task 2: MS Excel: Functions and formulas and graph plotting
Task 3: MS Power point presentation: Guidelines for effective presentation, inserting objects, charts, hyperlinks and navigation between slides
Task 4: Essentials Search Engines & Net etiquette, Plagiarism, Open source tools and other utility tools

Suggested Reading:

1. Scott Mueller's Upgrading and Repairing PCs, 18/e, Scott. Mueller, QUE, Pearson, 2008.
2. The Complete Computer upgrade and repair book, 3/e, Cheryl A Schmidt, Dreamtech

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16PY C04

APPLIED PHYSICS LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives: The objectives of the course is to make the student
1. Acquire knowledge in experiments of modern physics
2. Understand the characteristics of various semiconductor devises
3. Work with lasers and optical fibers

Course Outcomes: At the end of the course, the student will be able to
1. Understand the various applications of semiconductor devices and their suitability in engineering
2. Demonstrate the working of lasers and optical fibers and their applications in the field of communication
3. Analyze the electrical properties of a given solid based on its energy band gap
4. Verify the resistance and thermoelectric power properties with temperature variation
5. Demonstrate the concept of electron and its charge experimentally

List of Experiments:
1. Planck's Constant – Determination of Planck's Constant using photo cell
2. Solar Cell – Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance
3. Hall Effect– Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen
4. P-N Junction Diode – Study of V-I characteristics and calculation of resistance of given diode in forward and reverse bias
5. Laser – Determination of wavelength of given semiconductor red laser
6. Fibre Optics – Determination of NA and power losses of given optical fibre
7. Energy Gap – Determination of energy gap of given semiconductor
8. Thermistor – Determination of temperature coefficient of resistance of given thermistor
9. *e/m* of Electron by Thomson's Method
10. Thermoelectric Power – Determination of thermoelectric power of given sample

Note: A student must perform a minimum of eight experiments.

Suggested Reading:
1. "Applied Physics"- Manual by Department of Physics, CBIT, 2016
2. S.K. Gupta, "Engineering Physics Practical", Krishna's Educational Publishers, 2014
3. O.P. Singh, V. Kumar and R.P. Singh, "Engineering Physics Practical Manual", Ram Prasad & Sons Publications, 2009

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16CY C03

ENGINEERING CHEMISTRY LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives:

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory
2. For practical understanding of theoretical concept of chemistry

Course Outcomes:

1. This syllabus helps the student to understand importance of analytical instrumentation for different chemical analysis.
2. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.

List of Experiments:

1. Introduction to chemical analysis.
2. Preparation of standard solution of oxalic acid and Standardization of NaOH
3. Estimation of amount of Fe^{+2} in the given solution using Mohr's salt and $KMnO_4$
4. Estimation of amount of Fe^{+2} in the given solution using Mohr's salt and $K_2Cr_2O_7$
5. Estimation of amount of copper in the given solution using hypo solution.
6. Estimation of amount of HCl pH metrically using NaOH solution
7. Estimation of amount of CH_3COOH pH metrically using NaOH solution
8. Determination of concentration of given KMnO4 solution Colorimetrically
9. Determination of concentration of given $K_2Cr_2O_7$ solution Colorimetrically
10. Distribution of acetic acid between n-butanol and water.
11. Distribution of benzoic acid between benzene and water
12. Preparation of urea – formaldehyde / phenol- formaldehyde resin.

Suggested Reading:

1. Vogel' S text book of quantitative chemical analysis by J. Mendham and Thomas,Person education Pvt.Ltd New Delhi ,6th ed. 2002
2. Laboratory Manual on Engineering Chemistry by Dr. Subdharani (Dhanpat Rai Publishing
3. A Textbook on experiment and calculation in engineering chemistry by S.S. Dara S.Chand
4. Instrumental methods of Chemical Analysis, MERITT & WILLARD East-West Press

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16MT C05

ENGINEERING MATHEMATICS-III

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

Course objectives: *Students will be able to understand*

1. To study the expansion of functions in various intervals.
2. To form P.D.E and to find its solution.
3. To solve Wave, Heat & Laplace equations.
4. To learn Differentiation and Integration of complex valued functions.
5. To evaluate Complex Integration.
6. To evaluate Real definite integrals.

Course outcomes: *Students will able to*

1. Expand functions in the given intervals.
2. Solve linear and non linear PDEs.
3. Solve one-dimension, two-dimension, Heat steady state equations and also one-dimension wave equation.
4. Solve problems on Analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Expand functions by using Taylor's and Laurent's series.
6. Solve Real and Complex integrals by using Cauchy Theorems.

UNIT – I

Fourier series: Definition of Periodic, Single valued, finite maxima and minima of functions. Euler's Formulae, Dirichlets Conditions for Fourier expansion, Functions having points of discontinuity, Change of interval, Expansion of odd and even functions, Half-range sine series and cosine series.

UNIT-II:

Partial differential equations: Formation of partial differential equations by eliminating the arbitrary constants or arbitrary functions, solutions of linear partial differential equation of first order by using Lagrange's Method, solution of Non-linear partial differential equations of first order by using standard types, Charpit's Method.

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UNIT - III

Applications of Partial differential equations: Solution of partial differential equations by using method of separation of variables, solution of vibration of a stretched string (1D-Wave equation), one dimensional heat equation, Two dimensional heat equation under steady state conditions.

UNIT - IV

Theory of Complex variables: Analytic functions, Cauchy Riemann equations (Cartesian and polar forms), construction of Analytic functions by using Milne-Thomson's method. Harmonic function. Complex line integrals, Cauchy's theorem, Cauchy's Integral formula and its derivatives and problems related to the above theorems.

UNIT - V

Expansion of functions, Singularities & Residues: Taylor's and Laurent's series Expansions (Only statements). Zeros, types of singularities, Residues and Cauchy's Residue theorem, Evaluation of real integrals by Cauchy's residue theorem. Evaluation of improper real integrals of the type: $\int_{-\infty}^{\infty} f(x)dx$ Where f(x) has no poles on real axis and $\int_0^{2\pi} f(\sin\theta, \cos\theta)d\theta$.

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2015.
2. M.D. Raisinghania, "Advanced Differential equations", 7th edition, S Chand publishers, 2013.
3. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7th edition, McGraw Hill publishers, 2003.

Suggested Reading:

1. N P Bali and Manish Goyal, "A Text Book of Engineering Mathematics", 9th Edition, Laxmi publishers, 2016.
2. Alan Jeffrey, "Mathematics for Engineers and Scientists", 6th Edition, Chapman & Hall/CRC publishers, 2013.
3. A R Vasistha and R K Gupta, , "Integral transforms", Krishna prakashan publishers , 2004.
4. R.K.Jain & S.R.K.Iyenger, "Advanced Engineering Mathematics", 3rd edition, Narosa Publications, 2007.

16EC C02

NETWORK THEORY

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

Course Objectives: *Students will be able to understand*

1. The nature of different circuit elements, fundamental circuit laws, theorems and analyze circuits using graph theory.
2. The transient response of first, second order circuits and wave-shaping.
3. The concept of steady state and applying phasor analysis to AC circuits in sinusoidal steady state and analyzing magnetic coupled circuits.
4. Series and parallel resonant circuits, two port network parameters.
5. The concept of symmetrical and asymmetrical networks.
6. The concept of passive Filters.

Course Outcomes: *Students will able to*

1. Apply basic concepts of electric circuits and also simplify using network theorems. They will also be able to find Solution to networks using topological description.
2. Analyze RL,RC,RLC circuits using Transient and Steady State Responses for dc and ac input signals.
3. Represent vector, phasor diagrams and also find power calculations for ac circuits. They will be able to classify dot convention rules, self and mutual inductance for simple magnetic coupled circuits.
4. Discuss complex frequency analysis to series and parallel resonant circuits. Students will be able to compare Z,Y,H, two port network parameters and their interconnections.
5. Classify and define symmetrical and asymmetrical network characteristics.
6. Design and calculate parameters of passive filters.

UNIT-I

Basic Concepts of Electric Circuits: Classification of basic components, Ohm's law, Kirchoff's laws, network reduction techniques, nodal and mesh analysis, Source transformations, Star and Delta transformations, Thevenin's and Norton's theorems, Superposition theorem, Maximum power transfer theorem, Reciprocity theorem, Tellegen's theorem, Millman's Theorem, Duality Theorem.

Network Topology: Topological description of networks. Network graphs, tree, chord, incidence matrix, tieset matrix, cutset matrix. Formulation of node and loop equations and solution to networks.

UNIT-II

Time domain analysis: steady state and transient analysis for basic RL, RC and RLC circuits in linear time invariant first order and second order circuits, Formulation of integral, differential equations, Zero Input Response (ZIR), Zero State Response (ZSR), complete response.

Wave- Shaping: RC, RL and RLC circuits, response to Step, Pulse, Square wave inputs.

UNIT-III

Steady state Sinusoidal analysis: Steady state response of RLC networks to exponential signals, Sinusoidal signals, phasor and vector representations, impedance and admittance, application to network theorems.

Calculation of power in a.c. circuits: Average power, apparent power, complex power.

Magnetic 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, Pole-Zero cancellation, calculation of natural response from pole zero plot. 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, ideal transformers.

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UNIT-V

Symmetrical and Asymmetrical networks: Characteristic impedance, propagation constant, image and iterative impedances for T, π, L, Bridged T and Lattice networks. Introduction to Attenuators and equalizers.

Passive Filters: Classification of filters (Low pass, High pass, Band pass and Band stop), Characteristic impedance, Design of Constant K, m-derived and composite filters.

Text Books:

1. William H.Hayt, Jr.,Jack E. Kemmerly& Steven M.Durbin, "Engineering Circuit Analysis", 8th ed, McGraw Hill, 2013.
2. C.L.Wadhwa, "Network Analysis and Synthesis", 4th edition, New Age International Publications, 2016.

Suggested Reading:

1. M.E. Van Valkenburg M.E, " Network analysis" PHI, New Delhi, 3rd Edition 2002.
2. Charels A. Desoer and Ernest S Kuth, "Basic Circuit Theory" McGraw Hill, 2009.
3. Lawrence P. Huelsman, "Basic Circuit Theory" Pearson Publication, 3rd edition, 2009.

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16EC C03

ELECTRONIC DEVICES AND CIRCUITS

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

Course objectives: *Students will be able to understand*

1. The concepts of semiconductor devices like PN junction diode, Transistor, and special diodes.
2. The applications of diodes.
3. The various configurations, characteristics and biasing techniques of transistors – BJT, JFET & MOSFET.
4. The applications of transistor as a switch and an amplifier.
5. The analysis of BJT & FET in various configurations using small signal equivalent models.
6. The frequency response of various amplifiers.

Course Outcomes: *Students will 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. Modeling of different amplifiers.
4. 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.
5. Choose the best configuration for the specifications like ripple factor in case rectifiers, gain in case of amplifiers.
6. Design, develop and improve the performance of the amplifier circuits.

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UNIT – I

Semiconductor Diode Characteristics:

The p-n junction as a Diode and Energy Band Diagram, Current components in p-n diode, The Volt-ampere characteristics and temperature dependence, Diode Resistance, Transition Capacitance, Diffusion Capacitance, p-n diode switching times, Zener Diode, Zener voltage regulator and its limitation.

Elementary treatment of SCR- UJT- Diac- Triac - Varactor diode - PIN diode - Tunnel diode.

UNIT – II

Diode Applications:

Diode as a circuit element, small signal diode models, 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.

BJT biasing techniques, stability factors, Bias compensation techniques, Thermal runaway, Thermal stability, BJT as an amplifier and as a switch.

UNIT – IV

Field Effect Transistors:

The Junction Field Effect Transistor, the Pinch-off Voltage V_P, V-I characteristics of JFET. JFET biasing-zero current drift biasing, biasing of FET, FET as an amplifier and as a switch.

MOSFETs: Enhancement & Depletion mode MOSFETs, V-I characteristics, MOSFET as resistance, Biasing of MOSFETs, MOSFET as a switch, Introduction to FinFET.

UNIT – V

Amplifiers:

Analysis of BJT circuits using h-parameters in various configurations - their comparison (approximate and exact analysis), Millers Theorem & its duality – application circuits, frequency response. Analysis of FET circuits using equivalent model for various configurations - their comparison.

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.

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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16EC C04

SIGNALS AND 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: *Students will be able to understand*

1. 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. Sampling theorem, the time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transforms.
3. The concepts of convolution and correlation integrals and also the properties in the context of signals/systems.

Course Outcomes: *Students will able to*

1. Classify signals, systems and analyze the signals using Fourier series.
2. Understand signal spectrums and characterize the systems.
3. Represent the signals by generalized exponentials using Laplace transforms and evaluate LTI system characteristics.
4. Demonstrate conversion of continuous time signal to discrete time signal and obtain discrete system characteristics using DTFT and Z Transform.
5. Compare the signals using correlation.
6. Relate input and output response of the system using Convolution.

UNIT– I

Continuous Time Signals: Introduction to signals and their representations. Classification of signals. Introduction to systems and their classifications. Orthogonality of signals, Complete set of mutually orthogonal functions, Harmonic signals.

Signal Representation: Exponential Fourier series, Existence and Convergence. Symmetry conditions, Amplitude and Phase spectra. Properties of Fourier series. Power Spectral Density.

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UNIT – II

Signal Representation by Continuous Exponentials:

The direct and inverse Fourier transforms, Existence and properties of Fourier Transforms, Frequency spectrum. Fourier Transform of singularity functions and periodic signals. Energy Spectral Density, Filter characteristics of linear systems, Distortion less system, Phase delay and group delay. Causality and physical reliability: The Paley-weiner criterion.

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, Applications to circuit analysis (RL, RC and RLC). 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, Graphical interpretation and its properties.

Correlation: Continuous correlation: Cross correlation and Auto correlation, their graphical interpretation and properties. Discrete correlation: Cross correlation and Auto correlation, their graphical interpretation and properties.

Text Books:

1. B.P.Lathi, "Signals, Systems and Communications", BS Publications, 2008, 3rd Edition.
2. Alan V. Oppenheim,Alan S. Willsky,S.Hamid Nawad , "Signals and Systems" PHI 2nd Edition 2015.

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Suggested Reading:

1. Simon Haykin, “Signals and Systems,” Wiley India, 2009, 5th Edition.
2. M.J. Robert “Fundamentals of signals and systems”, McGraw Hill, 2008.
3. Narayana Iyer, “Signals and Systems”, Cengage learning, First Impression 2012.

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16EC C05

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

Instruction	4 Hours per week
Duration of Semester end Examination	3 Hours
Semester end Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: *Students will be able to understand*

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: *Students will 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. Compare the plane wave transmission and reflection at different boundaries.
5. Predict the behavior of reflection and refraction of the waves in different mediums.
6. Estimate the transmission line properties, reflection and matching concepts.

UNIT – I

Review of coordinate systems. Coulomb's Law, Electric field due to various Charge Distributions. Electric flux and flux density. Gauss Law: Integral form, point form and its applications. Work, Potential and Energy, Energy Density, Dipole, Laplace's and Poisson's equations. Current and Current Density, Continuity of current Equation, Relaxation Time.

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UNIT – II

Capacitance of Parallel plate, Coaxial and Spherical Capacitors.

Biot-Savart's law, Ampere's law: Integral form, point form and its applications. Stoke's theorem, Magnetic flux and magnetic flux density. Vector magnetic potential. Forces due to Magnetic Fields, Inductance: Self-inductance, calculation of inductance for simple structures.

UNIT – III

Time varying fields, Maxwell equations: Integral form and Point form. Boundary conditions.

Wave equations, Uniform plane waves in lossy and lossless medium. Skin Depth, Polarization, Instantaneous and average Poynting theorem and its applications.

UNIT – IV

Reflection and Refraction of Plane Waves - Normal and Oblique Incidence for both perfect Conductor and perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection.

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 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" 6th edition, 2015, Newyork Oxford University Press.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics" 8th edition, 2016, TMH.
3. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems" 2nd edition., 2000, PHI.

Suggested Reading:

1. "Networks Lines and Fields", John D. Ryder, 2nd edition, 2015, PHI.

16EC C06

ELECTRONIC WORKSHOP AND NETWORKS 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: *Students will be able to understand*

1. Understand the basic Concepts of Electric Circuits and equipment.
2. Understand the operation of CRO and LCR –Q meter.
3. Verify network theorems.
4. Design and verify Resonant circuits, Attenuators and passive filters.

Course Outcomes: *Students will able to*

1. Measure R,L,C components using electronic equipment.
2. Use CRO and power devices.
3. Conduct experiments on DC and AC circuits and also verify the network theorems.
4. Design passive filters.
5. Measure two port parameters.
6. Simulate a circuit 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 LCR - Q Meter.
3. Soldering for simple circuits.
4. Verification of Ohm’s law, KVL and KCL.
5. Verification of Superposition theorem and Tellegen’s theorem.
6. Verification of Thevenin’s and Norton’s theorems.
7. Verification of Maximum power transfer theorem and Reciprocity theorem.
8. Verification of Transient Response in RC, RL circuits for DC inputs.
9. Design and Verification of Series Resonance.

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10. Design and Verification of Parallel Resonance.
11. Measurement of two-port network parameters (Z,Y,h,T).
12. Design and Verification of Attenuators.
13. Design & verification of Constant-K low-pass & high-pass filters.
14. Design & verification of m-derived low-pass & high-pass filters.

Note: Experiments are to be simulated by using any simulating software.

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16EC C07

ELECTRONIC DEVICES 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: *Students will be able to understand*

1. The V-I characteristics of diodes.
2. The design and performance evaluation of various diodes as rectifiers.
3. The characteristics of transistor in various configurations.
4. The design of various biasing techniques for transistors –BJT, JFET.
5. The analysis of amplifiers –BJT, JFET.
6. The behavior of various special diodes.

Course Outcomes: *Students will 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 the biasing techniques, different configurations, characteristics of BJT & FET.
3. Model different amplifier circuits.
4. Examine different non-linear wave shaping circuits and draw an inference for their outputs. Distinguish different types of rectifying circuits and amplifier circuits and their performance parameters.
5. Choose the best configuration for the specifications provided.
6. Design, develop and improve the performance of the amplifier circuits.

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.

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4. Design, realization and performance evaluation of half wave rectifiers without filters and with filters(capacitor filter and π section filters).
5. Design, realization and performance evaluation of full wave rectifiers without filters and with C & 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 JFET in CS configurations and measurement of Transconductance and Drain resistance.
9. BJT biasing circuits.
10. FET biasing circuits.
11. Common Emitter BJT Amplifier and measurement of Gain, bandwidth, input and output impedances.
12. Common Source FET Amplifier and measurement of Gain, bandwidth, input and output impedances.
13. Emitter Follower / Source Follower circuits and measurement of Gain, bandwidth, input and output impedance.
14. Characteristics of special semi-conductor devices-UJT and SCR.
11. Characteristics of Tunnel diode and photo diode.

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.

Note:

1. Wherever possible, Analysis and design of circuits should be carried out using SPICE tools.
2. A minimum of 12 experiments should be performed.

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16EG CO3

SOFT SKILLS AND EMPLOYABILITY ENHANCEMENT 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: *Students will be able to understand*

1. Participate in group discussions and case studies with confidence and to make effective presentations. Also to learn the art of communication.
2. With- resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management & goal setting, self confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.
5. The elements of research and hone their soft skills through a live, mini project.

Course Outcomes: *Students will 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 mange 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. Do a live, mini project by collecting and analyzing data and making oral and written presentation of the same.

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Exercise 1

Group Discussion and Case studies: Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Elements of effective presentation, Structure of presentation, Presentation tools, Body language, Creating an effective PPT.

Exercise 2

Interview Skills: Resume writing, structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets.

Interview Skills: concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews.

Exercise 3

Personality Development: Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.

Exercise 4

Corporate Culture: Grooming and etiquette, communication media etiquette, Academic ethics and integrity.

Exercise 5

Mini Project: General/Technical research, developing a questionnaire, data collection, analysis, written report and project seminar.

Suggested Reading:

1. Dr. Shalini Verma, “Body Language- Your Success Mantra”, S Chand, 2006.
2. Ramesh, Gopalswamy, and Mahadevan Ramesh, “The ACE of Soft Skills”, New Delhi: Pearson, 2010.
3. Covey and Stephen R, “The Habits of Highly Effective People”, New York: Free Press, 1989.

16EC C08

DIGITAL LOGIC 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: *Students will be able to understand*

1. To learn various techniques for logic minimization.
2. To comprehend the concepts of various combinational circuits.
3. To understand the concepts of various sequential circuits.
4. To learn the fundamentals of Verilog HDL.
5. To learn the various abstraction levels in Verilog HDL.
6. To simulate and synthesize the process/concepts.

Course Outcomes: *Students will able to*

1.. The Various switching algebra theorems and minimization of switching functions.
2. The Structure of different digital logic elements like gates, multiplexers, encoders, decoders, adders and subtractors to build simple applications.
3. Different types of flip-flops and sequential circuits.
4. The Design of FSM.
5. The Design and simulation of various combinational and sequential logic circuits using Verilog HDL.
6. The Simulation and synthesis of digital logic design using Verilog HDL.

Unit-I

Introduction to Boolean algebra, Basic Postulates and theorems, Canonical forms and Standard forms, Simplification of switching function using theorems, 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.

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Unit-II

Binary Arithmetic Circuits: 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, Implementations of Logic Functions using Decoders and Multiplexers.

Unit-III

Introduction to Sequential Logic: Types of Flip-Flops, Excitation tables and Flip-Flop Conversions. Hold and setup times. Classification of sequential circuits. Shift registers and counters, Design of synchronous and asynchronous up/down counters, modulo-N counters.State Diagram, State Table, Mealy and Moore type FSM, Sequence Detection using FSM.

Unit-IV

Introduction to HDLs, 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 Modelling: 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.

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 Readings:

1. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL", PHI, 2005.
2. Donald P. Leach, Albert Paul Malvino, GouthamSaha, "Digital Principles and applications" 6th edition Tata McGraw Hill.
3. ZhiKohavi,NirajK.Jha, "Switching and Finite Automata Theory" 3rd edition, Cambridge Press.

16EC C09

ANALOG ELECTRONIC CIRCUITS

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

Course objectives: *Students will be able to understand*

1. The concept of multistage amplifiers and their analysis.
2. The concept of feedback amplifiers and their analysis.
3. The various multivibrators.
4. The various large signal amplifiers and their analysis.
5. The design and analysis of various tuned amplifiers.
6. The various regulators using transistors.

Course Outcomes: *Students will able to*

1. Define the high frequency model of BJT and FET.
2. Compare and contrast different types of multistage, feedback, power and tuned amplifiers.
3. Apply the concepts of BJT in multivibrators, feedback, multistage amplifiers and tuned amplifiers.
4. Categorize different types of feedback amplifiers, power amplifiers and voltage regulators.
5. Choose the best configuration for the specifications (like conversion efficiency in case power amplifiers, input and output impedance, resonating frequency and bandwidth).
6. Build narrow band amplifiers and improve the performance of the transistors voltage regulators.

UNIT – I

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) & FET, Amplifier Frequency response, Multistage amplifiers: low frequency and High frequency analysis of RC coupled, Transformer coupled and Direct coupled amplifiers with BJT and FET.

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UNIT – II

Feedback amplifiers:

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 III

Multivibrators:

Analysis and design of Transistor Multivibrators – Bistable, Monostable and Astable circuits. Operation of regenerative comparator (Schmitt Trigger).

UNIT – IV

Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Design considerations of transformer coupled and transformer less push-pull audio power amplifiers under Class-A, Class-B, Class D and Class-AB operations, Heat Sinks.

UNIT – V

Tuned Amplifiers:

General consideration, Analysis and design of single tuned, inductively coupled and double tuned types with BJT, selectivity, gain & bandwidth comparison of multistage single tuned and double tuned amplifiers, the problem of stability in RF amplifiers, Neutralization &unilaterisation staggered tuned amplifiers. Class B and Class C tuned amplifiers.

Regulators: Transistorized series and shunt regulators.

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, “Integrated Electronics”, 2nd Edition, McGraw Hill Publication, 2011.
2. Donald Schilling, Charles Belove, TuviaApelewicz Raymond Saccardi, “Electronic Circuits: Discrete and Integrated”, TMH, 3rd Edition, 2012.

Suggested Reading:

1. David Bell, “Fundamentals of Electronic Devices and Circuits”, 5th Edition, Oxford University Press 2008.
2. Robert L. Boylestad, “Electronic Devices and Circuit Theory”, 10th Edition, PHI, 2013.
3. Ben G Streetman and Sanjay Banerjee, “Solid State Electronic Devices”, 6th Edition, Pearson Education, 2005.

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16EC C10

ANALOG COMMUNICATION

Instruction	4 Hours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: *Students will be able to understand*

1. The concept of modulation and also analyze continuous / pulse modulation schemes.
2. The design procedure of AM and FM transmitters and receivers.
3. The concept of noise and its effect on modulation schemes and also to estimate the figure of merit.

Course Outcomes: *Students will able to*

1. Understand the need for modulation, representation of various AM modulation schemes and further they will able to generate and demodulate various types of AM signals.
2. Represent, analyze and distinguish FM and PM signals and also they will be able to generate and demodulate FM signals.
3. Understand the functioning of transmitters. They will be able to evaluate the radio receiver characteristics. To understand the necessity of Pre-emphasis and De-emphasis in FM broadcasting.
4. Understand and analyze the concept of Random Variable and Random Process. Further they will be able to evaluate the Response of Linear Systems for random signals.
5. Know the various sources of noise. They will be able to represent and analyze noise. Further they can evaluate and compare its effect on analog modulation schemes.
6. Demonstrate the Sampling theorem and analyze various sampling processes. Further they will be able to understand the various pulse modulation schemes.

UNIT – I

Linear Modulation Schemes: Need for Modulation, Double Side Band Suppressed Carrier Modulation, Balanced Modulator, Ring Modulator, Coherent Detector and Costas Detector.Conventional Amplitude Modulation, Phasor Diagram of AM, Switching Modulator,Square Law

Modulator, Envelope Detector. Hilbert Transform and its Properties, Complex Representation of Signals: Pre-Envelope, Complex Envelope, Natural Envelope, Canonical Representation of Band Pass Signals. Single Side Band Modulation, Phase Shift Modulator,Vestigial Side Band Modulation.

UNIT – II

Non-LinearModulation Schemes: Angle Modulation, Frequency Modulation and Phase modulation, Concept of Instantaneous Phase and Frequency. Types of FM modulation: Narrow Band FMand Wide Band FM.FM Spectrum in Terms of Bessel Functions. Phasor Diagram of NBFM. Frequency Multipliers and Mixers. Direct and Indirect (Armstrong's) methods of FM Generation. Balanced Slope Detector and Foster–Seeley Discriminator for FM Demodulation. Introduction to PLL.

UNIT – III

Transmitters and Receivers: High Level and Low Level AM Transmitters.FM Transmitters. Principle and Operation of Tuned Radio Frequency 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

Probability, Random Variables and RandomProcess : Probability, Joint and ConditionalProbability, Concept of Random Variables, Distribution and DensityFunctions and theirproperties: Binomial, Poisson, Uniform, Exponential, Gaussian and Rayleigh Distributions. Operations on RandomVariables:Moments about Origin and Central Moments. RandomProcess: Concept, Stationarity and Ergodicity, Auto CorrelationFunction, Spectral Characteristics : Power Spectral Density and itsProperties. Linear System withRandominputs:Random Signal Response of LinearSystem, Auto Correlation of Response.

UNIT – V

Noise : Noise Sources, Thermal Noise. White Noise andcoloured noise. 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.

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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, Wiley India, 2011.
2. Peyton Z. Peebles JR., “Probability Random Variables and Random Signal Principles”, Tata Mc Graw Hill, edition, 4/e, 2002.
3. Herbert Taub, Donald L. Shilling &GoutamSaha, “Principles of Communication Systems,” 3rd Edition, TMH, 2008.

Suggested Reading:

1. Singh, R.P. and Sapre, S.D., “Communication Systems,” TMH, 2007.

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16EC C11

ANTENNAS AND WAVE PROPAGATION

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

Course Objectives: *Students will be able to understand*

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: *Students will 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. Identify the significance of antenna array with respect to working principle and radiation pattern.
5. Understand the working principle and characteristics of various antennas.
6. Study the behavior of radio waves in various modes of wave propagation.

UNIT – I

Principles of radiation, retarded potential and isotropic radiator, 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, infinitesimal dipole.

UNIT – II

Half-wave dipole, quarter wave monopole, Effect of earth on vertical patterns, Loop antenna, Far field pattern of circular loop with uniform current.

Qualitative treatment of Helical Antennas: Axial mode pattern, wideband characteristics, radiation efficiency, Bandwidth.

UNIT – III

Arrays of point sources, two element array with equal and unequal amplitudes, different phases.Effect of inter element phase shift on beam scanning. Linear array with uniform distribution. Broadside and End fire arrays. Principle of pattern multiplication. Introduction to nonlinear arrays.

UNIT– IV

VHF, UHF Rhombic Antenna, Yagi - Uda Array, Design of Horn antenna, Parabolic Reflector and Cassegrain feed, Lens antennas. Log-Periodic antenna.Microstrip antennas: different types, advantages and disadvantages of Microstrip antennas, Design of rectangular Microstrip antennas.

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, Introduction to regular and irregular variations in ionosphere. Friis transmission formula, Line of sight propagation.

Text Books:

1. Constantine A. Balanis, "Antenna Theory: Analysis and Design," 3rd Edition, John Wiley, 2005.
2. John D. Krauss, Ronald J. Marhefka & Ahmad S. Khan, "Antennas and Wave Propagation," 4th Edition, TMH, 2010.
3. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2001.

Suggested Readings:

1. Chatterjee, R., "Antenna Theory and Practice", New Age Publishers, 2008.

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16EC C12

ELECTRONIC 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: *Students will be able to understand*

1. To impart a basic knowledge of International Standards for various physical quantities.
2. To provide a basic understanding of measurement systems and an in-depth understanding of measurement errors.
3. To expose the students to many varieties of transducers, measuring instruments, their Operating principles and construction.
4. To provide an idea of strengths and weaknesses of the various types of sensors and Transducers.
5. To introduce students to various types of spectrum analyzers, virtual instrumentation techniques and their applications.
6. To provide basic exposure to some of the prominent bio-medical Instrumentation systems.

Course Outcomes: *Students will able to*

1. Understand the various standards available for the measurement process.
2. Evaluate and perform accurate measurements for any engineering system with clear idea of the potential errors.
3. Understand the working principles of various transducers.
4. Select an appropriate transducer for given application.
5. Use instruments like spectrum analyzer, DSO and other virtual instrumentation techniques for appropriate measurements.
6. Understand the fundamentals of various Biomedical instrumentation systems.

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UNIT– I

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

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

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

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

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, 2010.
2. H S Kalsi, “Electronic Instrumentation”, 3/e, TMH, 2011.
3. Nakra B.C, and Chaudhry K.K., “Instrumentation, Measurement and Analysis”, TMH, 2004.

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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.

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16MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

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

Course Objectives: *Students will be able to understand*

1. to introduce managerial economics and demonstrate its importance in managerial decision making.
2. to develop an understanding of demand and relevance of its forecasting in the business.
3. to provide the basics of market structure and the concept of equilibrium in different market structures.
4. to examine the economic analysis of production process, types of inputs and to explain different costs and their relationship with the output.
5. to understand the importance of project evaluation in achieving a firm's objective.
6. to explain the concept of Accountancy and provided knowledge on preparation and analysis of Final accounts.

Course Outcomes: *Students will able to*

1. apply fundamental knowledge of Managerial economics concepts and tools.
2. understand various aspects of demand analysis and forecasting.
3. understand price determination for different markets.
4. study production theory and analyze various costs & benefits involved in it so as to make best use of resources available.
5. analyze different opportunities and come out with best feasible capital investment decisions.
6. apply accountancy concepts and conventions, Final accounts and financial analysis.

UNIT-I: Introduction to Managerial Economics

Introduction to Economics and its evolution - Managerial Economics - its scope, importance, Its usefulness to engineers - Basic concepts of Managerial economics.

UNIT-II: Demand Analysis

Demand Analysis - Concept of demand, determinants, Law of demand, its assumptions, Elasticity of demand, price, income and cross elasticity, Demand Forecasting – Types of Market structures. (Simple numerical problems).

UNIT-III: Production and Cost Analysis

Theory of Production - Firm and Industry - Production function - input-out relations - laws of returns - internal and external economies of scale. Cost Analysis: Cost concepts - fixed and variable costs - explicit and implicit costs - out of pocket costs and imputed costs - Opportunity cost - Cost output relationship - Break-even analysis. (Theory and problems).

UNIT-IV: Accountancy

Book-keeping, principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments.

UNIT-V: Capital Budgeting

Introduction to capital budgeting, Methods: traditional and discounted cash flow methods. Introduction to Working capital management. (Numerical problems).

Text Books:

1. Mehta P.L., “Managerial Economics –Analysis, Problems and Cases”, Sultan Chand & Son’s Educational publishers, 2013.
2. Maheswari S.N. “Introduction to Accountancy”, Vikas Publishing House, 2013.
3. Panday I.M. “Financial Management”, Vikas Publishing House, 11th edition, 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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16EC C13

DIGITAL LOGIC DESIGN LAB USING VERILOG

Instruction	3Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: *Students will be able to understand*

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 of digital design.
4. To simulate various abstraction levels.
5. To learn and implement procedure for any digital design.

Course Outcomes: *Students will 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. 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.

16EC C14

ANALOG ELECTRONIC CIRCUITS 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: *Students will be able to understand*

1. The basic knowledge of various multivibrators.
2. The design and analysis of the multistage amplifiers.
3. The frequency response and behavior of various feedback amplifiers.
4. The generation of analog signals using oscillators.
5. The design and analysis of power amplifiers.
6. The design concepts of tuned amplifiers and band width measurement.

Course Outcomes: *Students will able to*

1. Define the bandwidth of multistage amplifiers using BJT and FET.
2. Compare and contrast different types of multistage configurations, feedback, power, tuned amplifiers.
3. Apply the concepts of analysis of BJT and compare the results in the lab for multi-vibrators, feedback, multistage amplifiers and tuned amplifiers.
4. Categorize different types of feedback amplifiers, power amplifiers and voltage regulators.
5. Choose the best configuration for the specifications (like conversion efficiency in case power amplifiers, input and output impedance, resonating frequency and band-width).
6. Build narrow band amplifiers and improve the performance of the transistors voltage regulators.

ANALOG CIRCUITS LAB

1. Design and development of Astable multivibrator.
2. Design and development of Monostable multivibrator.
3. Design and development of Bistable multivibrator.

4. Design and development of Schmitt Trigger.
5. Design and development of Voltage to Frequency converter.
6. Design andfrequency response of Single stage and Multistage RC - Coupled amplifier using BJT.
7. Design andfrequency response of Single stage and Multistage RC - Coupled amplifier using FET.
8. Voltage series feedback amplifier.
9. Voltage shunt feedback amplifier.
10. Current series feedback amplifier.
11. Current shunt feedback amplifier.
12. RC Phase Shift Oscillator.
13. Hartley Oscillator &Colpitts Oscillator.
14. Design of Class-A power amplifier.
15. Design of Class-B power amplifier.
16. Tuned Amplifiers (Single and Double).

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”, 7^{th} Edition, TMH 2001.

Note:

1. Wherever possible, Analysis and design of circuits should be carried out using SPICE tools.
2. A minimum of 12 experiments should be performed.

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16EC C15

ANALOG COMMUNICATION 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: *Students will be able to understand*

1. The concepts of various modulation schemes like AM, FM &PM.
2. The generation & detection methods of FM and AM.
3. The principles of various AM and FM transmitters and receivers.
4. The representation and analysis of various noise sources.

Course Outcomes: *Students will able to*

1. Demonstrate the generation and detection of various analog modulated signals.
2. Understand the sampling concept and further they can generate and detect various pulse modulated signals.
3. Obtain and analyze frequency response of Pre-Emphasis and De-Emphasis circuits.
4. Evaluate Mixer, Radio receiver and PLL characteristics.
5. Understand the concept of multiplexing and also can compare FDM and TDM techniques.
6. Estimate the Power spectral density of noise and Signal to Noise ratio and further able to analyze spectrums of AM and FM signals.

List of Experiments

1. AM signals generation and detection.
2. Generation of DSB-SC using Balanced modulator.
3. SSB Modulation and Demodulation.
4. FM generation and detection.
5. Frequency response of Pre-Emphasis and De-Emphasis circuits.
6. Evaluation of Radio Receiver characteristics.
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.
12. Determination of PLL Characteristics.
13. Analysis of Mixer Characteristics.
14. Spectral Analysis of AM and FM signals using Spectral Analyzer.

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EC 311

LINEAR INTEGRATED CIRCUITS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To learn the basic building blocks of linear integrated circuits.
2. To study the applications of Operational Amplifiers.
3. To learn the theory and applications of active filters, PLL, 555 timers, ADC and DAC.

Course Outcomes:

1. Understand the building blocks of Op-Amp.
2. Implement the applications of Operational Amplifiers.
3. Analyze and Design of active filters, PLL, 555 Timers, ADC and DAC

Unit – I

Differential Amplifiers: Classification, DC and AC analysis of single/dual input balanced and unbalanced output configurations using BJTs and MOSFETs.

Operational Amplifier: Op-Amp block diagram, ideal Op-Amp Characteristics, Op-Amp and its features, Measurement of Op-Amp parameters: Input and Output offset voltages and currents, Slew rate, CMRR, PSRR. Frequency response and compensation techniques.

Unit – II

Op-Amp Applications I: Inverting and Non-inverting amplifiers with ideal and non-ideal Op-amps, Voltage Follower, Difference Amplifier, Summing Amplifier, ideal and practical Integrator and differentiator, Voltage to Current and Current to Voltage converters, Instrumentation amplifier, Sample and Hold circuit, Log and Antilog amplifiers, Analog multiplier and divider, Precision rectifiers.

Unit – III

Op-Amp Applications II: Comparator, Schmitt Trigger with and without reference voltage, Astable Multivibrator, Monostable Multivibrator, Triangular waveform generator.

Active Filters: Introduction, Analysis of Butterworth first order, second order lowpass and highpass filters, Band-pass filters, Band-stop filters, Notch filter, All-pass filter.

Unit – IV

555 Timer: Introduction and its functional diagram. Modes of operation: Monostable, Astable multivibrators, applications of 555 Timer.

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Function Generator: Analysis and Design of Function Generator using IC 8038.
Voltage Controlled Oscillator: Operation and applications using IC 566.
Phase Locked Loops: Introduction, Principles, Block diagram and Description of IC 565, Applications of PLL: frequency multiplication and frequency synthesis.

Unit – V
Regulators: Introduction, Analysis and design of regulators using 78XX and 723 monolithic ICs, Current limiting and Current foldback techniques using IC 723.
Data Converters: Introduction, specifications, DAC- Weighted Resistor, R-2R Ladder, ADC- Parallel Comparator, Successive Approximation and Dual Slope.

Text Books:

1. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits," 4/e, PHI, 2010.
2. Roy Chowdhury D, Jain S.B.," Linear Integrated Circuits,"4/e, New Age International Publishers, 2010.

Suggested Reading:

1. K.R.Botkar, "Integrated Circuits," 10/e, Khanna Publishers, 2010.
2. David A.Bell, 'Op-Amp & Linear ICs', Oxford, 2013.
3. Sedra and Smith, "Micro Electronic Circuits", 6/e, Oxford University Press, 2009.

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EC 312

DIGITAL INTEGRATED CICUITS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To study the characteristics and operations of Bipolar and MOS logic families.
2. To analyze the operations and implementation of various combinational and sequential logic circuits using IC's.
3. To study the architecture and operation of different programmable devices.

Course Outcomes:

1. Understand the characteristics and operation of Bipolar and MOS logic families.
2. Design and implementation of various combinational and sequential logic circuits using IC's.
3. Understand the architecture and operation of different programmable devices.

Unit-I: Bipolar Logic Families

Integrated circuits classification, Integrated circuit package types, pin identification and temperature ranges, IC characteristics. TTL logic family, TTL series, TTL output configurations: open collector, Totem pole, Tri state logic. ECL logic family.

Unit-II: MOS Logic families

MOS logic family (PMOS and NMOS), CMOS logic family and its series characteristics, CMOS transmission gate (bilateral switch) and its applications, CMOS open drain and high impedance outputs. Dynamic MOS logic family, dynamic MOS inverter, dynamic MOS NAND and NOR gates. Comparison of various logic families. Interfacing of logic families: CMOS driving TTL, TTL driving CMOS, ECL driving TTL and TTL driving ECL.

Unit-III: Combinational Circuits

Design using TTL-74XX and CMOS 40XX series: Decoders, drivers for LED and LCD display, Encoder, priority encoder, Multiplexer and their applications, Demultiplexer, Parity generator and Checker circuit, Digital comparator, Parallel and serial binary adder, Subtractor circuits using 2's complement. Carry look-ahead adder, Decimal adder, Decimal Subtractor using 10's complement, Binary Multiplier.

Unit-IV: Sequential circuits

Flip-flops and their conversions. Design of Synchronous and Asynchronous counters, Cascading of BCD counters, applications of counters, Shift register and applications with 74XX and CMOS 40XX series of IC Counters. Sequence generation, Sequence detection.

Unit-V: Memories

ROM, RAM types, Architectures, operation and applications, Flash memory, Expanding word size and capacity, Introduction to PLD's, Architecture of PAL, PLA with operation, Introduction to CPLD and FPGA architectures.

Textbooks:

1. Ronald J. Tocci, Neal S. Widmer & Gregory L.Moss, "Digital Systems: Principles and Applications." PHI, 10/e, 2009.
2. Charles H Roth and Larry L Kinney, "Fundamentals of Logic Design" 7th edition, Cengage Publication, 2014.

Suggested Reading:

1. Jain R.P., "Modern Digital Electornics."4/e, TMH, 2011.
2. Sonde, B.S. "Introduction to system Design using IC's" Wiley, 2/e, 1994.

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EC 313

COMPUTER ORGANIZATION AND MICROPROCESSORS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To learn the concepts of computer arithmetic operations, computer instructions and its memory organization
2. To examine the 8086 and 8088 microprocessors in terms of hardware/software and functions of signals generated/accepted.
3. To understand the 8086/8088 architecture and its programming.
4. Explore how to interface the memory and I/O devices to 8086 microprocessor.

Course Outcomes:

1. Mathematically represent and analyze the computer arithmetic operations.
2. Write an assembly language programming for different applications.
3. Design an 8086 based microcomputer by interfacing memory and I/O devices.

Unit- I

Data representation and Computer arithmetic: Introduction to computer systems, organization and architecture, evolution and computer generations; 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.

Basic Computer organization: Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle; Program interrupt, Interrupt cycle.

Unit-II

Central Processing Unit: General register organization, stack organization, instruction formats, addressing modes, Data transfer and manipulation, Program control. Characteristics of CISC and RISC.

Memory organization: Memory hierarchy, Primary memory, Auxiliary memory, Cache memory: mapping functions, Virtual memory: address mapping using paging and Segmentation.

Unit–III

8086/8088 Microprocessor: Architecture and Pin diagram of 8086/8088 microprocessor, Register organization, Memory organization, Instruction set, Minimum and Maximum mode operations, 8086 control signal interfacing under minimum mode system, control signal interfacing under maximum mode

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using multiprocessing systems. Addressing modes, Interrupt structure. Brief overview of x86 series microprocessors.

Unit–IV

8086 Assembly Language programming: Assembler directives and operators, programs using data transfer, arithmetic, logical, branching and ASCII instructions. String processing, Procedures, Macros and stack, Basic programs using DOS functions. Introduction to assemblers and debugging tools.

Unit–V

8086 Interfacing: Memory interfacing using standard RAM, EPROM IC Chips, 8255 PPI, 8253/8254 programmable interval timers, 8257 DMA controller, 8279 Keyboard and display controller interfacing and 8251 programmable communication interface. Serial and parallel data transmission formats, USART interfacing.

Text Books:

1. Morris Mano M. "Computer System Architecture" , 3/e, Pearson Education, 2005.
2. Ray A.K. and Bhurchandi, K.M., "Advanced Microprocessor and peripherals", 2/e TMH –2007.
3. Barry B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro, Pentium II, III, IV", Pearson Education, 2006.

Suggested Reading:

1. William Stallings, "Computer Organization and Architecture Designing for performance" 7/e, Pearson Education, 2006.
2. Douglas V Hall, "Microprocessors and interfacing, Programming and Hardware", 2/e, TMH, 2006.

EC 314

CONTROL SYSTEMS ENGINEERING

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To acquire the basic concepts of automatic control systems
2. To learn the basics of control systems representations/modeling
3. To learn stability analysis in time and frequency domains.

Course Outcomes:

1. Represent the mathematical model of a system and analyze the stability of the system.
2. Determine the response of different systems to a step input. Analyze the system in frequency domain.
3. Understand the discrete data control systems and modern control systems

Unit I

Control System Fundamentals and Components: Classification of control systems, Open and closed loop systems, Control system components; Error sensing devices - potentiometers, synchros, AC & DC servo motors, Mathematical modeling of mechanical systems and their conversion into electrical systems. Block diagram reduction and signal flow graphs.

Unit II

Time response: Transfer function and Impulse response, Types of inputs, Transient response of second order system for step input, Time domain specifications. Types of systems, static error coefficients, error series, Routh - Hurwitz criterion for stability. Root locus techniques: Analysis of typical systems using root locus techniques. Effect of location of roots on system response.

Unit III

Frequency response plots: Bode plots, frequency domain specifications. Gain margin and Phase Margin. Principle of Argument, Nyquist plot and stability criterion.
Compensation: Cascade and feedback compensation using Bode plots. Phase lag, lead, lag-lead compensators. PID controller.

Unit IV

Discrete Data Control Systems: Digital control system, advantages and disadvantages, digital control system architecture, Discrete transfer function, Sampled data system, Transfer function of sample data systems and Stability of discrete data systems.

Unit V

State Space Representation: Concept of state and state variables. State models of linear time invariant systems, State transition matrix and solution of state equations, Controllability and Observability, Design of digital control systems using state space concepts.

Text Book:

1. I.J .Nagrath & M.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. Gopal Madan, "Digital Control Engineering" 1/e, New age publishers, 2008.

EC 315

DIGITAL COMMUNICATION

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To learn various digital pulse modulation and digital carrier modulation techniques.
2. To learn the different source coding and channel coding schemes.
3. To learn the need for spreading a code and various spread spectrum techniques.

Course Outcomes:

1. Understand the knowledge of digital pulse modulation and digital carrier modulation techniques.
2. Analyze the different source coding and channel coding schemes.
3. Understand various spread spectrum 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. Introduction to linear prediction theory, Differential quantization, Differential PCM system, Delta Modulation, Noise in DM system, ADM. Comparison of PCM and DM systems.

Unit-II

Information Theory: Uncertainty, Information and Entropy. Source coding: Shannon – Fano algorithm and Huffman coding. Discrete memoryless channels, Probability relations in a channel, priori and posteriori entropies, 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, 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. M-ary Signaling Schemes, M-ary coherent PSK(QPSK only). 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. Syncronization in Spread Spectrum Modulation.

Text Books:

1. Simon Haykin, "Communication Systems," 4/e, Wiley India, 2011.
2. Sam Shanmugham.K., "Digital and Analog Communication Systems," Wiley, 1979.

Suggested Reading:

1. Herbert Taub, Donald L. Shilling & Goutam Saha, " Principles of Communication Systems," 4/e, Tata McGraw-Hill Education 2013.
2. R.P. Singh, S.D. Sapre, "Communication Systems", 2/e, Tata McGraw-Hill Education, 2008.

CE 444 **HUMAN VALUES AND PROFESSIONAL ETHICS**

Instructions	: 21 Periods per semester (7*3)
Duration of University Examination	: 2 Hours
University Examination	: 50 Marks
Sessional	: Nil
Credits	: Nil

Course Objectives:

1. To develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. To enable the students understand the values, the need for value adoption and prepare them meet the challenges
3. To enable the students develop the potential to adopt values, develop a good character and personality and lead a happy life
4. To motivate the students practice the values in life and contribute for the society around them and for the development of the institutions /organisation around they are in.
5. To make the students understand the professional ethics and their applications to engineering profession

Course Outcomes

1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, convert everything into happiness and contribute for the happiness of others.
4. Students become potential sources for contributing to the development of the society around them and institutions / organisations they work in.
5. Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

UNIT-1 Concepts and Classification of Values –Need and challenges for value Adoption

Definition of Values – Concept of Values – Classification of Values – Hierarchy of Values – Types of Values –Espoused and Applied Values – Value judgement based on Culture – Value judgement based on Tradition – Interdependence of Values

Need for value education – Findings of Commissions and Committees - Corruption and illegal practices – Science and Technology without values- Exploitation of nature – Increasing use of violence and intoxicants – Lack of education in values – Implications of education in values – Vision for a better India

Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges

UNIT – 2: Personal Development and Values in Life Personal Development: Enlightened self-interest – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity – The quest for Character – Tests of Character – The key to good character

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Values in Life: Building an ethical policy – Integrating values in everyday life – Archaic Social Values – Parenting practices – Critical Thinking - Analyzing and Prioritizing values – Practicing Yoga and Meditation

UNIT – 3: Practicing Values for the development of Society

Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atrocities – Environmental awareness – Working for the Sustainable development of the society

Values in Education system: Present Scenario- Engineering education –Current trends- Need for quality improvement- Adoption of value education – Principles of Integrity-Institutional Development.

UNIT – 4: Basic Concepts of Professional Ethics

Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional ethics, Ethical dilemmas, Indian and Global thoughts on ethics, Profession, Professional and Professionalism, Ethical role of a professional Basic ethical principles, Some basic ethical theories, use of ethical theories.

Science, Religion Ethics, Genders and ethics, Media and ethics, Computer Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities

UNIT-5: **Ethics in engineering profession**

Engineering profession-Technology and Society-Engineering as Social Experimentation-Engineering ethics-Ethical obligations of Engineering Professionals-Role of Engineers-Engineers as Managers-Professional responsibilities of Engineers- Engineers Responsibility for Safety- A few Case Studies on Risk management

Conflicts of Interest- Occupational Crimes- Plagiarism-Self plagiarism-Ethics Audit-Consideration for ethics audit-Ethics Standards and Bench Marking

Text Books:

1. Subramanian R., “ Professional Ethics “ , Oxford University Press , 2013
2. Nagarajan R.S., “ A Text Book on Human Values and Professional Ethics “ New Age Publications , 2007
3. Dinesh Babu S., “ Professional Ethics and Human Values “ , Laxmi Publications , 2007

Reference Books:

4. SantoshAjmera and Nanda Kishore Reddy “ Ethics , Integrity and Aptitude “ ,McGrawhill Education Private Limited , 2014
5. GovindaRajan M., Natarajan S., Senthil Kumar V.S.” Professional Ethics and Human Values “ Prentice Hall India Private Limited ,2012
6. Course Material for Post Graduate Diploma In “Value Education & Spirituality “ Prepared by Annamalai University in Collaboration with Brahma Kumaris , 2010

EC 316

INTEGRATED CIRCUITS LAB

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. To measure the characteristics of Op Amp and implementing the arithmetic circuits, filters, oscillators using Op Amp.
2. To analyze the operation and implementation of circuits using IC 566, IC 723, IC 555.
3. To Design and Implementation of Combinational and Sequential Circuits.

Course Outcomes:

1. Measure the characteristics of Op-Amp and implement the arithmetic circuits, filters, oscillators using Op Amp.
2. Analyze the operation and implement of circuits using IC 566, IC 723, IC 555
3. Design and Implement of Combinational and Sequential Circuits.

Lab Experiments

Part-A

1. Measurement of Op-Amp parameters.
2. Voltage Follower, Inverting and Non Inverting Amplifiers using Op-Amp.
3. Arithmetic Circuits: Summer, Subtractor, Integrator and Differentiator using Op-Amp.
4. Active filters: LP, HP and BP using Op-Amp.
5. Astable, Monostable multi vibrators using Op-Amp.
6. Triangle and Square wave generators using Op-Amp.
7. Voltage Controlled Oscillator Using IC 566.
8. Low and High Voltage Regulators using IC 723.
9. Astable, Monostable multi vibrators using IC 555 Timer.

Part-B

1. Measurement of propagation delay, fan-out, Noise margin and transfer Characteristics of TTL and CMOS IC gates.
2. (a) Design of code converters using logic gates.
   (b) Parity generator and checker circuits.
3. Logic function Implementations using Multiplexers

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4. Arithmetic Circuits: Binary adder and subtractor, BCD adders using IC's.
5. Flip-Flop operations and conversions using gates and ICs
6. Design of Synchronous, Asynchronous up/down counters.
7. Shift registers and ring counter using ICs.
8. Interfacing counters with 7-segment LED display units.

General Note:
1. At least 5 experiments from each part.
2. At least 3 or 4 experimetns should be carried out using SPICE tools.

Reference Book: Laboratory Manual.

Mini Project cum Design Exercise(s):

To realize and design mini project using either linear or digital or combination of linear and digital IC's (giving specifications for each project).

a) Design a crystal oscillator for the given specifications frequency= 1 KHZ, Amplitude=1 Vpp, duty cycle=50%.
b) Design a universal shift register using JKFF.
c) Construct an electronic harmonium using 555 Timer that performs server rhythemic sounds.
d) Design of Digital clock.
e) Design of Security Monitoring system

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EC 317

MICROPROCESSOR AND INTERFACING LAB

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

To Develop and understand the Assembly language programming concepts of 8086 Microprocessor.

Course Outcomes:

1. Write the 8086 assembly language programs on arithmetic, logical operations and DOS function calls.
2. Interface memory and I/O devices with 8086 microprocessor.
3. Design and develop the 8086 based microcomputer system for various applications.

Lab Experiments

1. Programs using Arithmetic operations, Branching Operations.
2. Logical operations and string operations.
3. Multiplication and division for signed/unsigned data.
4. Single byte, multi byte binary and BCD addition and subtraction.
5. Code conversions.
6. String Searching and Sorting.
7. Using DOS function calls.
8. Interfacing traffic signal control using 8086.
9. Generation of waveforms using DAC interface.
10. Interfacing stepper motor control using 8086.
11. Interfacing 7 -segment LED (Common Cathode/Common Anode) displays.
12. Generation of waveforms and gating applications using 8253/8254 timers.
13. Real time clock using 8086.
14. Interfacing Elevator simulator control using 8086.

Mini Project cum Design Exercise(s).

To design and realize a mini project using 8086 microprocessor and interface modules.

Suggested Reading:

1. Walter A. Triebel, Avtar Singh "The 8088 and 8086 Microprocessors: Lab Manual" PHI 2nd Edition 2000

EC 318

DIGITAL COMMUNICATION LAB

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. To carry out experiments on various pulse digital modulation and digital carrier modulation techniques.
2. To verify the Line coding techniques.
3. To verify the error control coding schemes.

Course Outcomes:

1. Analyze the pulse digital modulation and digital carrier modulation schemes through experiments.
2. Analyze the Line coding techniques.
3. Measure the error controlling schemes.

List of Experiments:

1. PCM generation and detection.
2. Error control coding.
3. Data formats / Line coding.
4. Linear Delta Modulation and demodulation.
5. Adaptive Delta Modulation and demodulation.
6. ASK generation and detection.
7. FSK generation and detection.
8. BPSK generation and detection.
9. QPSK generation and detection.
10. Minimum Shift Keying generation and detection.
11. Modem characteristics.
12. Wavelength division multiplexing and demulitiplexing.

General Note: At least 10 experiments are to be conducted.

Reference Book: Laboratory Manual.

Mini Project:

1. Develop a code for different digital modulation schemes and verify through simulation.
2. Design different Line coding schemes using logic Gates.
3. Study and design the multiplexing techniques.

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EC 321

MICROCONTROLLERS AND APPLICATIONS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To understand the 8051 and ARM Microcontroller architecture and instruction set.
2. To acquire the knowledge of interfacing memory and I/O devices.
3. To learn the 8051and ARM based embedded applications.

Course Outcomes: Students will be able:

1. Write an assembly language programming and Embedded C programming for different applications.
2. Interface memory and I/O devices to 8051/ARM.
3. Design a Microcontroller based embedded system for various applications.

UNIT-I

8051 Microcontroller: Introduction to Microcontroller, Overview of 8051 family, Internal Architecture of 8051, PSW, Pin description, I/O Ports, Memory organization and expansion. 8051 Instruction set: Addressing modes and Bit addressable features, 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: 8051/8031 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: ARM Design Philosophy, ARM Processor families, Architecture-revisions, Registers, Current Program Status Register, pipeline, exception, interrupts and the vector table; core extensions, introduction to ARM instruction set.

UNIT-V

Applications of Microcontrollers: Design and development of the applications in the area of communications (GSM module, GPS, Zigbee), Keil IDE features and RTOS with 8051 in the area of automotive applications.

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. Andrew N.Sloss, Domonic Symes, Chris Wright "*ARM System Developers Guide Designing and optimizing system software*" Elsevier 1st Edition 2004.

References:

1. Ayala, K.J., "*The 8051 Microcontroller Architecture, Programming and Applications*", Penram International, 2007.
2. Rajkamal, "*Microcontrollers Architecture, Programming Interfacing and system Design*", Pearson Education 2007.
3. Steve Furber., "*ARM System-on-Chip Architecture*" 2nd Edition Addison-Wesley, 2000.

EC 322

MICROWAVE ENGINEERING

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To prepare students to understand basic principle of microwave and its applications.
2. To prepare students to understand different microwave components and analyzing different type of junctions used in microwave engineering.
3. To teach the students about various microwave solid state devices and their characteristics.

Course Outcomes:

1. Students will be able to calculate cut off frequency, identify possible modes and obtain mode characteristics of Reflex Klystron and Gunn oscillator.
2. The students would be able to understand the principles of operation of waveguide, gyrator, isolator attenuator etc. and obtain scattering matrix for various junctions like E-plane, H plane, Circulator, Direction Coupler.
3. Students will know the basics of microwave solid state devices such as Gunn diode and Avalanche Devices such as IMPATT, TRAPATT diodes and efficiently use them in microwave engineering applications.

UNIT - I

Guided Waves: Propagation of TE, TM and TEM waves between parallel planes. Velocity of propagation, wave impedance, attenuation in parallel plane guides.

UNIT - II

Waveguides: TE and TM waves in rectangular and circular waveguides, Wave Impedance, Characteristic Wave Impedance, Attenuation and Q of waveguides. Cavity resonators, resonant frequency and Q, Applications of cavity resonator.

UNIT - III

Microwave Circuits and Components: Concept of Microwave circuit, Normalized voltage and current, Introduction to scattering parameters and their properties, S parameters for reciprocal and Non-reciprocal components- Magic Tee, Directional coupler, E and H Plane Tees and their properties, Attenuators, Phase Shifters, Isolators and circulators.

UNIT- IV

Microwave Tubes: High frequency limitations of conventional tubes, Bunching and velocity modulation, mathematical theory of bunching, principles and operation of two cavity, multi cavity and

Reflex Klystron. Theory of crossed field interaction; Principles and operation of magnetrons and crossed field amplifiers, TWT and BWO.

UNIT – V

Microwave Solid State Devices: Principles of operation, characteristics and applications of Varactor, PIN diode, GUNN diode and IMPATT diode. Elements of strip lines, microstrip lines, slot lines and fin–lines.

Microwave measurements: Microwave bench set up to obtain characterstics of RKO and Gunn oscillator, VSWR measurement, Impedence measurement, measurment of coupling coefficent and direcvity of directionnal couplers, Measurement of radiation patterns and gain for horn antenna.

Text Books:

1. E. C. Jordan & Keith G. Balmain, "Electromagnetic Waves and Radiating Systems", 2/e, Pearson Education, 2006.
2. Samuel Y. Liao, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.

Suggested Reading:

1 Rizzi P, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
2 R. E. Collins, "Foundations for Microwave Engineering", 2/e, Wiley India Pvt. Ltd., 2012.
3. Sushrut Das, "Microwave Engineering" 1/e, oxford press, 2014.

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EC 323

DIGITAL SIGNAL PROCESSING

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To design digital IIR and FIR filters for the given specifications.
2. To learn the basics of Multirate digital signal processing and its applications
3. To learn the DSP processor architecture for the efficient implementation of digital filters.

Course Outcomes:

1. Design and implement FIR and IIR filters for the given specifications.
2. Understand the concepts of Multirate digital signal processing and its applications.
3. Implement the filters using DSP Processors.

Unit-I

Fourier Transform: Overview of Discrete time Fourier Transform (DTFT), 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. Use of FFT algorithms in Linear Filtering and Correlation.

Unit-II

FIR Filter Design: Amplitude and phase responses of FIR filters – Linear phase filters –Windowing technique for design of FIR filters – Rectangular, Bartlet, Hamming, Blackman, Kaiser Windows. Realization of filters-Direct form-I and II, cascade and parallel forms of FIR and IIR filters. Finite word length effects.

Unit-III

IIR Filter Design: Butterworth and Chebychev approximation, IIR digital filter design techniques-Impulse Invariant transformation, Bilinear transformation techniques, Butterworth and Chebychey 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. Implementation of Sampling Rate Conversion, Multistage implementation of Sampling Rate Conversion, Sampling Rate Conversion by an arbitrary factor, Applications of Multirate Signal Processing.

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Unit-V

DSP Processors: Introduction, Differences between DSP and General Purpose Processor architectures, need for DSP processors. General purpose DSP processors: TMS 320C54XX processor, architecture, 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, 2007.
3. Avtar Singh & S. Srinivasan, "Digital Signal Processing Implementation using DSP microprocessors", Thomson Brooks, 2/e, 2004.

Suggested Reading:

1. Chi- Tsong Chen, "Digital Signal Processing Spectral Computation and filter Design", Oxford, 2/e, 2007.
2. Tarunkumar Rawat, "Digital Signal Processing", First edition, Oxford, 2015.

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EC 324

MOBILE CELLULAR COMMUNICATIONS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course objectives:

1. To understand the concept and implementation of frequency reuse and Handoff techniques and to analyze interference and capacity enhancement.
2. To appreciate the factors influencing outdoor and indoor propagation systems and to analyze various multiple access protocols based on their merits and demerits.
3. To visualize the system architectures and implementation of GSM and CDMA based mobile communication systems.

Course outcomes:

1. Design a Cellular layout for Mobile communications using frequency reuse for maximum coverage, less interference and optimum capacity.
2. Chose an appropriate Propagation model for either Outdoor or Indoor cellular communication and to identify the salient features protocols pertaining to various multiple access systems.
3. Analyze the system specifications of either GSM or CDMA based Mobile Communication systems and how they have been changing from generation to generation.

UNIT - I

Basic Cellular system and its operation: frequency reuse, channel assignment strategies, Handoff process, factors influencing handoffs, handoffs in different Generations, Interference and system capacity, Cross talk, Enhancing capacity and cell coverage, Trunked radio system, grade of service as per Erlang's B system.

UNIT – II

Propagation models: Free space propagation model, three basic propagation mechanisms, practical link budget design using path loss models, outdoor propagation models: Durkin's model and indoor propagation model, partition losses. Small scale multipath propagation, Parameters of mobile multipath channels, Diversity reception, types of small scale fading.

UNIT – III

Multiple Access Techniques: FDMA, TDMA, SSMA, FHMA, CDMA, SDMA.

UNIT – IV

GSM & CDMA Technologies: GSM: Services and Features, System architecture, Radio Sub system, Channel Types, Frame structure and Signal processing. CDMA: Digital Cellular standard IS-95, Forward Channel, Reverse Channel. Introduction to CDMA 2000.

UNIT – V

Technology Trends & Specifications : WLAN, Bluetooth, PAN, introduction to OFDM in Wireless communication Trends in Radio and Personal Communications, UMTS system architecture and Radio Interface, Comparison of 1G, 2G, 2.5G and 3G technology, Features of 4G,

Text Books:

1. Theodore.S. Rappaport, “Wireless Communications: Principles and Practice”, 2/e, Pearson Education, 2010
2. William. C.Y.Lee, “Mobile Communication Engineering”, 2/e , Mc-Graw Hill, 2011.
3. T.L.Singal “Wireless Communication Systems”, 1/e, TMH Publications, 2010.

Suggested Reading:

1. William.C.Y.Lee, “Mobile Cellular Telecommunications: Analog and Digital Systems”, 2/e, Mc-Graw Hill, 2011.
2. Dharma Prakash, Quing-an-Zeng, Agarwal, "Introduction to Wireless & Mobile Systems", Cengaje Publications, 3rd edition, 2012.

EC 351

CODING THEORY AND TECHNIQUES
(ELECTIVE – I)

Instruction	4 Periods/week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To study the importance of channel coding techniques in digital communications.
2. To learn the mathematical structure and algorithms for RS and turbo codes.

Course Learning Outcomes:

1. Understand the theory and principles of channel Coding and techniques.
2. Analyze the performance of RS and turbo codes.

Unit-I

Coding for Reliable Digital Transmission and Storage: Introduction, Types of codes, Types of errors, Channels models, Modulation and coding, channel coding Theorem, Channel coding gain.

Unit II

Linear Block codes: Introduction, encoding, syndrome decoding, error-detecting and correcting capabilities, Maximum likelihood decoding.

Cyclic codes: Description, encoding and syndrome decoding.

Unit III

Galois Fields: Groups, Fields, Binary arithmetic, Construction of Galois Fields GF(2^m), Basic properties of Galois Fields.

RS codes: Introduction, encoding and decoding (Berlekamp-Massey algorithm).

Unit IV

Convolution codes: Introduction, Encoding, State diagram, Trellis diagram, Decoding -Maximum-Likelihood decoding, soft decision and hard decision decoding, Viterbi algorithm.

UNIT V

Turbo codes: Concatenation, Types of Concatenation, interleaving, types of interleavers, Turbo codes: Introduction, encoding and decoding (BCJR Algorithm).

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Text books:

1. Shulin and Daniel J. Costello, Jr. "Error Control Coding," 2/e, Pearson, 2011.
2. L.H.Charles LEE "Error control block codes for Communication Engineers", Artech, 2000.

Suggested readings:

1. Simon Haykin, "Communication Systems", 4/e, Wiley, 2000.
2. K Sam Shanmugum, "Digital and Analog Communication Systems", Wiley, 2005.

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EC 352

OPTICAL FIBER COMMUNICATION
(ELECTIVE – I)

Instruction	4 Periods/week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Learn concepts of propagation through optical fiber, Losses and dispersion thorugh optical fiber.
2. Understand operating principles of light sources and detecters used in optical transmitters and Receivers.
3. Design an optical link in view of loss and dispersion.

Course Outcomes:

1. To analyze the propagation thourgh optical fiber for different modes and understand different sources of loss and dispersion.
2. To study optical transmitters and receivers.
3. To design an optical fiber link based on power budget and time budgets.

UNIT – I

Elements of Optical Fiber Systems: Fiber Transmission link, Ray Optics, Optical Fiber Modes and Configurations, Mode theory of Circular Waveguides, Overview of Modes and Key concepts, Linearly Polarized Modes, Single Mode Fibers and Graded Index fiber structure.

UNIT – II

Losses and Dispersion: - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides-Information Capacity determination, Group Delay, Material Dispersion, Waveguide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in Guided Index fibers, Mode Coupling, Design Optimization of Single Mode fibers-Refractive Index profile and cut-off wavelength.

UNIT – III

Optical Transmitters: Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency, LED power, Modulation of LED, laser Diodes, Modes and Threshold condition, Rate equations, External Quantum efficiency, Resonant frequencies, Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers, Power Launching and coupling, Lensing schemes, Fiber-to-Fiber joints, Fiber splicing.

UNIT – IV

Optical Receivers: PIN and APD diodes, Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise, Comparison of Photo detectors, Fundamental Receiver Operation, preamplifiers, Error Sources, Receiver Configuration, Probability of Error, Quantum Limit.

UNIT – V

Link design considerations: Point-to-Point link -Link Power budget, Rise - time budget, Noise Effects on System Performance, Operational Principles of WDM, Erbium-doped Amplifiers.

Text Books:

1. Gourd Keiser, "Optical Fiber Communication" TMH, 4/e, 2000.
2. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994.

Suggested Readings:

1. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.
2. Binh, "Digital Optical Communications", First Indian Reprint 2013, (Taylor & Francis), Yesdee Publications.

EC 353

CPLD & FPGA ARCHITECTURES

(ELECTIVE – I)

Instruction	4 Periods/week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Familiarization of various complex programmable Logic devices of different families.
2. To study Field programmable gate arrays and realization techniques.
3. To study different case studies using one hot design methods and studying System level Design

Course Outcomes:

1. Implementation of various logic circuits on PLDs, CPLDs and FPGAs.
2. Analyze different FSM techniques like petrinets.

UNIT I

Programmable logic: ROM ,PROM ,PLA,PAL,SPLD, CPLD and FPGA, Features, Architectures, Programming, Applications and Implementation of MSI circuits using Programmable logic Devices.

UNIT II

CPLD's: Complex Programmable Logic Devices, logic block, I/O block, interconnect matrix, logic blocks and features of Altera flex logic 10000 series CPLD's , max 7000 series CPLD's, AT & T – ORCA's (Optimized Reconfigurable Cell Array), Cypres flash 370 device technology, Lattice pLSI's 3000series.

UNIT III

FPGAs: Field Programmable Gate Arrays – Logic blocks, routing architecture, Logic cells and features of commercially available FPGA's- XILINX XC4000, Virtexii FPGA's, XILINX SPARTAN II, Alteras Act1, Act2, Act3 FPGA's, Actel FPGA's, AMD FPGA.

UNIT IV

Finite State Machines (FSM): Top Down Design, State Transition Table , State assignments for FPGAs, Realization of state machine charts using PAL, FSM Architectures: Architectures Centered around non registered PLDs, Design of state machines centered around shift registers, One_Hot state machine, Petrinets for state machines-Basic concepts and properties, Finite State Machine-Case study.

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UNIT V

System Level Design: Controller, data path designing, Functional partition, Digital front end digital design tools for FPGAs & ASICs, System level design using mentor graphics EDA tool (FPGA Advantage), Design flow using CPLDs and FPGAs.

Suggested Reading:

1. S. Trimberger, Edr, “Field Programmable Gate Array Technology”, Kluwer Academic Pub., 1994.
2. Richard F.Tinder, “Engineering Digital Design”, 2/e, Academic press
3. Charles H. Roth, “Fundamentals of logic design”, 4/e, Jaico Publishing House.

References:

1. P.K.Chan & S. Mourad, “Digital Design Using Field Programmable Gate Array”, PHI, 1994.
2. S. Brown, R.J.Francis, J.Rose, Z.G.Vranesic, “Field programmable gate array”, BSP, 2007.
3. Manuals from Xilinx, Altera, AMD, Actel.

EC 354

Analog and Mixed IC Design
(Elective - I)

Instruction	4 Periods/week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:
1. Familiarization of current mirrors and their application in the design of Operational Amplifiers.
2. To study the various design issues of Op-Amps and their different architectures.
3. To study different types of data converter circuits.

Course Outcomes:
1. Able to gain the knowledge about various issues of Op-Amp design
2. Understand various other Op-Amp architectures
3. Students will be able to realize an A/D or D/A converter using current mirrors circuits.

UNIT I

Basic MOS Devices and Current Mirrors:

MOS Structure, I/V characteristics, MOS device models, Second Order Effects, Advanced MOS Modeling.

Simple CMOS current mirror, Common source amplifier, Source follower, Common gate stage, Source degenerated current mirror, High output impedance current mirrors, Cascode gain stage, Bipolar current mirrors, Bipolar gain stage, Frequency response of amplifiers.

UNIT II

Design of Op-Amp and its Frequency Response:

MOS Differential pair and gain stage, bi-polar differential pair and gain stage.

Operational Amplifiers: Two stage Op-Amps, Feedback and Op-amp Compensation, Common Mode Feedback, Input range limitation, Slew-rate, Power supply rejection, Multipole systems, Phase margin, Frequency compensation.

Advanced current mirrors, Folded Cascade Opamp, Current Mirror Opamp, Fully Differential Opamp, Current Feedback Opamp.

UNIT III

Design of Comparator and Switched Capacitor Circuits:

Use of Opamp for a Comparator, Charge Injection Error, Latched Comparators, CMOS Comparator and Bipolar Comparator.

Basic building blocks of switched capacitor, Basic Operation and Analysis, First order, Bi-quad, Charge Injection, Switched Capacitor Gain Circuit, Correlated Double Sampling Techniques, Other Switched Capacitor Circuits.

UNIT IV

S/H Circuits and Data Converters:

Sample and hold circuits: Performance and basics of sample and hold circuit, examples of CMOS, Bi-Polar sample and hold Circuits.

Converters: Ideal D/A converters, Ideal A/D converters, Quantization Noise, Signed codes, Performance limitations.

Nyquist Rate D/A Converters: Decoder based Converters, Binary scaled Converters, Thermometer code Converter -realization of converters using current mirrors.

UNIT V

Nyquist Rate A/D Data converters:

A/D Converters: Integrating Converter, Successive Approximation Converter, Cyclic A/D, Flash Converter, Two step A/D Converter, Interpolating A/D, Folding and Pipe-Lined, Time Interleaved Converters-realization of converters using current mirrors.

Text Books:

1. D.A John & Ken Martin, "Analog Integrated Circuit Design". John Wiley Publications, Reprint 2011.
2. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata-McGraw Hill Publications,2002.

Suggested Reading:

1.Philip E. Allen & Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford University Press, 2002

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EC 326

MICROCONTROLLER LAB

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

To develop and understand the assembly and embedded C programming concepts of 8051 Microcontroller

Course Outcomes:

1. Write and test the assembly language programs on arithmetic and logical operations.
2. Write and test embedded C programming on interfacing modules
3. Design and develop the 8051 based embedded systems for various applications

I. List of Experiments

1.2.3. Familiarity and use of 8051 Microcontroller trainer - Instruction set for simple program (using 4 to 15 lines of instruction Code) for data transfer, manipulation, Arithmetic perations, Branching operations, logical operations and testing of "byte/bit patterns" in a given data.

4. Timer and Counter operations & Programming using 8051.
5. Interfacing 8051 with DAC to generate the waveforms
6. Interfacing traffic signal control using 8051.
7. Program to control stepper motor using 8051.
8. LEDs and Switches interfacing with 8051 programming in C.
9. Relay and Buzzer interfacing with 8051 programming in C.
10. LCD interfacing with 8051 programming in C.
11. ADC interfacing with 8051 programming in C.
12. DC Motor interfacing with 8051 programming in C.
13. 7-Segment display interfacing with 8051 programming in C.
14. Elevator simulator interfacing with 8051 programming in C.
15. RTC interfacing with 8051 programming in C

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Mini Project cum Design Exercise(s).

To design and realize a mini project using 8051/ARM and interfacing modules.

Suggested Reading:

1. Myke Predko - Programming and Customizing the 8051 Microcontroller, TMH, 2005.

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EC 327

MICROWAVE LAB

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. The student would understand the characteristics of RKO and Gunn oscillator.
2. Measurement of frequency and wavelengths would be learnt by the student.
3. VSWR various TEES would be understood by the student.
4. Radiation pattern would be learnt by the student for horn antenna.

Course Outcomes:

After undergoing the course, the student would be able to

1. Analyze the characteristics of RKO and Gunn oscillator are drawn and studied by the student.
2. Measure the frequency and guided wavelength are found and measured by the student.
3. Estimate the VSWR for various loads and S-Matrix for various microwave devices.
4. Obtain the horn antenna radiation pattern.

LIST OF EXPERIMENTS

1. Characteristics of Reflex Klystron oscillator, finding the mode numbers and efficiencies of different modes.
2. Characteristics of Gunn diode oscillator, Power Output Vs Frequency, Power Output Vs Bias Voltage.
3. Measurement of frequency and Guide wavelength calculation:
   i. Verification of the relation between Guide wavelength, free space wavelength and cutoff wavelength of X- band rectangular waveguide.
   ii. Verification of the straight line relation between $(1/\lambda_g)^2$ and $(1/\lambda_0)^2$ and finding the dimension of the guide.
4. Measurement of low and high VSWRs: VSWR of different components like matched terminals, capacitive and inductive windows, slide screw tuner for different heights of the tuning posts etc.
5. Measurement of impedance for horn antenna, Matched load and slide screw tuner.
6. To find the S-parameters of Directional coupler.
7. To find the S-parameters of Tees: E plane, H plane and Magic Tee.
8. To find the S-parameters of Circulator.
9. Measurement of radiation patterns for basic microwave antennas like horn and parabolic reflectors in E-plane and H-plane. Also to finding the gain, bandwidth and beamwidth these antennas.

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10. Study of various antennas like dipoles, loops, Yagi antenna, log periodic antenna and their radiation pattern.

Mini Project:

i. To design microwave components such as: Directional couplers, circulators and Hybrid junctions using Simulation software.

ii. To design antenna arrays such as: Binomial, Chebyshev, using Simulation software.

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EC 328

DIGITAL SIGNAL PROCESSING LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. Design the IIR and FIR filters using matlab.
2. Design multistage decimator using matlab.
3. Study the operation and performs of TMS320C6713 floating point processor.

Course Outcomes:

1. Design and implement digital filters using matlab.
2. Design and implement mutlirate techniques using matlab.
3. Implement digital filters using TMS320C6713 floating point processor.

(A) Experiments on signal processing using MATLAB.

1. Basic matrix operations and Generation of test signals.
2. Linear Convolution, circular convolution and Correlation.
3. DFT and FFT algorithm.
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.

(B) Experiments on DSK and CCS

1. Familiarity with CCS and DSK kit.
2. Response of a LTI system to a ramp/step input.
3. Linear Convolution.
4. Discrete Fourier Transform (DFT).
5. Implementation of FIR filter.
6. Implementation of second order IIR filters.

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Note:

1. Minimum of 6 from Part A and 4 from Part B is mandatory.
2. For section “A”, MATLAB with toolboxes like Signal Processing, FDA or LAB VIEW software can be used.

Reference Book:

1. Vinay K.Ingle and John G. Proakis, “Digital Signal Processing using MAT LAB “, 4/e, Cengage learning, 2011.
2. B.Venkataramani and M. Bhaskar, “Digital Signal Processor Architecture, Programming and Application”, sixth edition, TMH, 2006.

EC 411

RADAR SYSTEMS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To learn the principles of operation of radar systems.
2. Be able to design and simulate radar systems.
3. Be able to know the various types of tracking radars.
4. Be able to understand various types of radar clutters.
5. Be able to know the various types of radar displays.

Course Outcomes:

Student will be able to:

1. Understand the principles of operation of pulse radar system.
2. Know the applications of CW and FMCW radar.
3. Understand the working principle of MTI and Pulse Doppler Radar and matched filter concepts.
4. Get familiarization of various radar clutters and Phased array antennas.
5. Compare various tracking radars along with their advantages and disadvantages.
6. Understand various radar displays and radar receiver.

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 lobing, conical scan, monopulse: amplitude comparison and phase comparison methods, Low angle tracking, tracking in range, comparison of various trackers, Radar antennas.

UNIT-IV

Radar Clutter: Introduction to radar clutter, surface clutter radar equation, Land clutter, Sea clutter, statistical models for surface clutter, detection of targets in clutter, Phased array Antennas.

UNIT-V

Radar receiver**:** The radar receiver, receiver noise figure, Super heterodyne receiver, importance of Matched filter, Duplexers and receiver protectors, Radar Displays.

Text Books:

1. Merril. I. Skolnik, "Introduction to Radar Systems", 2/e, MGH, 2001.
2. Mark A. Richards, James A. Scheer and William A. Holm, "Principles of Modern Radar: Basic Principles," YesDee Publishing Pvt. Ltd., India, 2012.

Suggested Reading:

1. Byron Edde, "Radar: Principles, Technology, Applications", Pearson, 2008
2. G.S.N Raju, "Radar Engineering And Fundamentals Of Navigational Aids", I.K. International publishing house Pvt. Ltd., 2010.

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EC 412

DATA COMMUNICATION AND COMPUTER NETWORKS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To provide a conceptual foundation for the study of data communications using the open Systems interconnect (OSI) model for layered architecture.
2. To study the principles of network protocols and internetworking
3. To understand the Network security and Internet applications.
4. To understand the concepts of switched communication networks.
5. To understand the performance of data link layer protocols for error and flow control.
6. To understand various routing protocols.

Course Outcomes:

After completing this course the 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 understands ATM network concepts.
3. Analyze the performance of various Data link control protocols for flow control and error control.
4. Analyze the services and functions of the networks layer and recognize the different internetworking devices and their functions.
5. 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.
6. Understand the importance of basic network security measures such as encryption, Authentication protocols and study standard Internet applications protocols.

UNIT-I

Introduction:
Data Communications 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.

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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, 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. Internet Working. 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 Protocols: 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.

Textbooks:

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 Communications and Networking", Fourth Edition. McGraw-Hill Forouzan Networking Series, McGraw-Hill, 2007
2. S. Keshav, "An Engineering Approach to Computer Networks", Second Edition, Addison-Wesley Professional Pearson Education, 2001

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EC 413

VLSI DESIGN

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To study the basic concepts of verilog HDL.
2. To learn the various abstraction levels in verilog HDL.
3. To understand simulation and synthesis process/concepts.
4. To learn the various characteristics of MOS transistor.
5. To learn the various concepts required to obtain the digital logic layout diagrams.
6. To learn various subsystem design concepts.

Course Outcomes:

The student will be able to

1. Design and simulate various combinational and sequential logic circuits using verilog HDL
2. To simulate and synthesize digital logic designs.
3. Understand characteristic behaviour of MOSFET and layout desig rules.
4. Design CMOS based logic circuits.
5. Understand the design concepts of memories.
6. Understand the concepts of VLSI testing.

UNIT - I

Introduction to HDLs, Basic Concepts of Verilog, Data Types, System Tasks and Compiler Directives. Gate Level Modeling: Gate Types and Gate Delays. Dataflow Modeling: Continuous Assignment and Delays. Design of Stimulus Block.

UNIT - II

Behavioural Modeling: Structured Procedures, Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks. Switch level Modeling.UDP. Design of Mealy and Moore state models using Verilog. Logic Synthesis, Synthesis Design flow, Gate level Netlist.

UNIT - III

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.

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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: Design of Dynamic Register Element, 3T, 1T 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, Sholeh Eshraghian, "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.

EC 414

ELECTRONIC INSTRUMENTATION

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To impart a basic knowledge of International Standards for various physical quantities
2. To provide a basic understanding of measurement systems and an in-depth understanding of measurement errors.
3. To expose the students to the many varieties of transducers and measuring instruments, their operating principles, construction.
4. To provide an idea of the strengths and weaknesses of various types of sensors and transducers
5. To introduce students to various types of spectrum analyzers, virtual instrumentation techniques and their applications
6. To provide the students a basic exposure to some of the prominent bio-medical instrumentation systems

Course Outcomes:

Students will be able to:

1. Perform accurate measurements for any engineering system with clear idea of the potential errors
2. Know several important standards related to measurements and quality management
3. Select the appropriate passive or active transducers for measurement of physical phenomenon
4. Understand the operating principles of various types of transducers used to measure temperature, displacement, and other physical quantities.
5. Use instruments like spectrum analyzer, DSO and other virtual instrumentation techniques for appropriate measurements.
6. Understand the fundamentals of various Biomedical instrumentation systems

UNIT– I

Accuracy, Precision, Resolution and Sensitivity. Errors and their types. Calibration. Standards of measurement, classification of standards, IEEE standards, Elements of ISO 9001, Quality management standards.

UNIT – II

Classification of transducers, factors for selection of a transducer, transducers for measurement of velocity, force, Hot wire anemometer. Passive electrical transducers- Strain gauges - gauge

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factor types of strain gauges: rosettes, semiconductor stain gauges and strain measurement, LVDT-construction and displacement measurement, capacitive transducer and thickness measurement. Active electrical transducers: Piezo-electric, photo-conductive, photo-voltaic and photo-emissive transducers.

UNIT – III

Characteristics of sound, pressure, power and intensity levels. Microphones and their types. Temperature measurement, resistance wire thermometers, semiconductor thermometers and thermocouples. Humidity measurement, resistive capacitive, aluminum oxide and crystal Hygrometer types. Introduction to Micro-Electro-Mechanical Systems (MEMS).

UNIT – IV

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

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, 2010.
2. H S Kalsi, "Electronic Instrumentation", 3/e, TMH, 2011.
3. Nakra B.C, and Chaudhry K.K., "Instrumentation, Measurement and Analysis", TMH, 2004

Suggested Readings:

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 2nd Edition, 2003.
2. Khandpur. R.S., "Handbook of Bio-Medical Instrumentation", TMH, 2003.
3. Biomedical Instrumentation and Measurements – Leslie Cromwell and F.J. Weibell, E.A. Pfeiffer, PHI, 2nd Ed, 1980.

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ME 419

INDUSTRIAL ADMINISTRATION AND FINANCIAL MANAGEMENT

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To make the students understand the roll importance and functions of Management in Industrial Organization
2. To make the students understand various types of business organizations and organization structures.
3. To make the students understand importance of plant location and plant layout
4. To ensure that the students understand the importance of industrial engineering students like method study and work measurement.
5. To make the students understand the importance of project management techniques
6. To make the students calculate 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 and importance of management and its principles.
2. Understand the need and importance of various types of layouts used in manufacturing industries
3. Apply the techniques of method study and work measurement in industry to enhance productivity
4. Apply the techniques of project management in industry
5. Understand the importance of quality control and plot the control charts

6.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,

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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", 13th edition, 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, Tata McGraw Hill, 3rd Edition, 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, Prentice Hall of India, 5th Edition, 2005.
6. S.D. Sharma, "Operations Research", Kedarnath, Ramnath & Co., Meerut,2009

EC 462

EMBEDDED SYSTEMS

(Elective - II)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To learn about fundamentals of the embedded system design
2. To understand the hardware and software details of the embedded systems.
3. To acquire knowledge on the serial, parallel and network communication protocols.
4. To understand the embedded system design life cycle and co-design issues.
5. To learn about the various embedded software development tools.
6. To design the embedded system for various applications.

Course Outcomes:

Student will be able to

1. Know the fundamentals of the embedded systems
2. Know the hardware and software details of the embedded systems.
3. Interface serial, parallel and network communication protocols to embedded systems
4. Know the embedded system design life cycle and co-design issues.
5. Analyze the various embedded system applications
6. Develop the various embedded system applications

UNIT – I

Introduction To Embedded Systems: Embedded systems Vs General Computing Systems, History of embedded systems, classifications, applications areas, characteristics and quality attributes of embedded systems, Design metrics and challenges in embedded system design.

UNIT – II

Embedded Hardware and Software: Processor embedded into a system, Processor selection for embedded system, embedded hardware units and devices in a system, embedded software in a system and an overview of programming languages, challenges and issues related to embedded software development.

UNIT – III

Communication protocols: I^2C, CAN, USB, Firewire-IEEE 1394 Bus standard, Advanced serial high speed buses. Parallel Bus device protocols: ISA, PCI, PCI-X , ARM Bus, Advanced parallel high speed buses. Internet Enabled Systems-Network protocols: HTTP, TCP/IP, Ethernet. Wireless and mobile system protocols

UNIT – IV

Embedded System design and co-design issues in system development process, Design cycle in the development phase for an Embedded Systems. Embedded software development tools: Host and Target Machines, Linker/Locators for embedded software, Embedded Software into the Target system. Issues in hardware and software design and co-design

UNIT – V

Integration and testing of embedded hardware, testing methods, debugging techniques, Laboratory tools and target hardware debugging: Logic Analyzer, simulator, emulator and In-circuit emulator, IDE, RTOS Characteristics, Case Study: Embedded Systems design for automatic vending machines and digital camera.

Text Books:

1. Raj Kamal, "Embedded Systems-Architecture, Programming and Design," 3/e, Tata McGraw Hill Education, 2015.
2. Shibu K V, "Introduction to Embedded systems", 1/e, McGraw Hill Education, 2009.
3. Frank Vahid and Tony Givargis, "Embedded System Design: A Unified Hardware/Software Approach, 1999.

Suggested Reading:

1. David E.Simon, "An Embedded software primer", Pearson Education, 2004.
2. Embedded System Design : A Unified Hardware/ Software Introduction, 1/e, Wiley, John & Sons.

EC 464

SATELLITE COMMUNICATION
(Elective - II)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course objectives:

1. To develop awareness about satellite communication system architecture and satellite orbits.
2. To acquire the knowledge about orbital effects and mechanics of launching a satellite.
3. Study of various satellite subsystems.
4. To design a satellite link considering different parameters like noise and losses.
5. To familiarize with the satellite applications.

Course outcomes:

Student will be able to:

1. Understand the development history and applications of satellite systems
2. Know the orbital effects and mechanics of launching a satellite would be understood by the student.
3. Analyze the various Satellite subsystems.
4. Understand the role and importance of a satellite transponder.
5. Analyze the link budget of a satellite link for specified C/N ratios.
6. Know the applications of satellite like VSAT and DBS.

UNIT-I

Introduction of satellite communications

Brief history of satellite communications, Block diagram of earth segment and space segment, Brief introduction of Indian scenario in communication satellites.

Orbital aspects of Satellite Communication

Introduction to geo-synchronous and geo- stationary satellites, Kepler's laws (statements and explanation only), applications of satellite communications.

UNIT-II

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, Orbital perturbations, mechanics of launching a synchronous satellite.

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UNIT-III

Satellite sub-systems

Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system, Communications subsystems (transponders), Space craft antennas, multiple access techniques, comparison of FDMA, TDMA, CDMA.

UNIT-IV

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.

UNIT-V

Introduction to Direct Broadcast Satellite Television

C band and Ku band home satellite TV, Block diagram of Digital DBS TV Overview of VSAT systems, VSAT network architecture, One way and two way implementation.

Text Books

1. Timothy Pratt and Charles W Bostian,Jeremy E.Allnutt, “Satellite Communications”, 2/e, John Wiley, 1986.
2. Dennis Roddy “Satellite Communications", Fourth edition”, Mc Graw Hill, 2006.

Suggested Reading:

1. 1. M. Richharia, “Satellite Communication Systems: Design Principles”, Mc Graw Hill, 2/e, 2003.

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Hyderabad-500 075

EC 415

ELECTRONIC DESIGN AND AUTOMATION LAB

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. To simulate and synthesize combinational logic circuits
2. To simulate and synthesize sequential logic circuits
3. To obtain RTL schematic
4. To simulate switch level modules
5. To learn implement procedure for any design on FPGA
6. To study the speed, power and area constraints of FPGA/CPLD

Course Outcomes:

The student will be able to

1. Simulate and synthesize combinational logic circuits
2. Simulate and synthesize sequential logic circuits
3. Obtain gate level net-list and RTL diagrams
4. Implement sequence detector using FSM on FPGA
5. Implement mini projects on FPGA/CPLD
6. Design adder using UDP

Part A

Write the Code using VERILOG, Simulate and synthesize the following

1. Arithmetic Units: Adders and Subtractors.
2. Multiplexers and De-multiplexers.
3. Encoders, Decoders, Priority Encoder and Comparator.
4. Implementation of logic function using Multiplexers and Decoders.
5. Arithmetic and Logic Unit with minimum of eight instructions.
6. Flip-Flops.
7. Registers/Counters.
8. Sequence Detector using Mealy and Moore type state machines.
9. Implementation of any application of UDP.

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Note:-

1. All the codes should be implemented appropriately using Gate level, Dataflow and Behavioral Modeling.
2. All the programs should be simulated using test benches.
3. Minimum of two experiments to be implemented on FPGA/CPLD boards.

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 any basic circuit using CADENCE tool.

Mini project:

i) Design a 8-bit CPU.
ii) Generation of different waveforms using DAC.
iii) RTL code for Booth's algorithm for signed binary number multiplication.
iv) Development of HDL code for MAC unit and realization of FIR Filter.
v) Design of 4-bit thermometer to Binary Code Converter.

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ADVANCED SIMULATION LAB

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

LAB EXPERIMENTS

1. Familiarization with simulation tools like LabVIEW and Network Simulator2 (NS2)
2. Working with loops, Structures and Mathscripts
3. (a) Combinational circuits(Adders , Substractors , Mux , Demux, Decoder and Encoder)
   (b) Sequential circuits (Flip flops, counters and registers)
4. (a) Convolution and correlation of signals
   (b) Filters (FIR and IIR)
5. (a) Analog modulation and demodulation schemes(AM and FM)
   (b) Digital carrier modulation and demodulation schemes (ASK and FSK)
6. (a) Time domain analysis (State variable analysis)
   (b) Frequency domain analysis (Nquist and Bode plots)
7. Study of basic features and functions of RTOS (VxWorks)
8. VxWorks Task function programming
9. VxWorks Timer programming
10. VxWorks IPC Programming-I
    (a) Signals
    (b) Semaphores
11. VxWorks IPC Programming-II
    (a) Message Queques
    (b) Mail boxes
12. Creation of a network with at least four nodes.
13. Transmission between the nodes in a network.
14. Simulation of the data transfer between the nodes using TCP

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Mini Project cum Design Exercise(s).

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
(e) Universal shift registers
(f) Code converters
(g) PLL
(h) Implementation of the Real time scheduling algorithms

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EC 417

PROJECT SEMINAR

Instruction	3L Periods per week
Sessionals	25 Marks
Credits	1

The objective of the project seminar is to actively involve the student in the initial work required to undertake the final year project. Dealing with a real time problem should be the focus of the under graduate project.

It may comprise of

- Problem definition and specifications.
- A broad understanding of the available techniques to solve a problem of interest.
- Presentation (Oral & written) of the project.

The department should appoint a project coordinator who will coordinate the following.

- Grouping of students as project batch(a maximum of 3 in group)
- Allotment of projects and project guides
- Project monitoring at regular intervals.

Each project group/batch is required to

1. Submit a one page synopsis of the seminar to be delivered for display on notice board.
2. Give a 30-40 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write up on the talk delivered.

Three (3) teachers will be associated with the evaluation of the project seminar for the award of the sessional marks which should be on the basis of performance on all the three items stated above.

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EC 421

GPS AND AUGMENTATION SYSTEMS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Prerequisite: A prior knowledge of satellite communication and Radio Navigation Aids is required.

Course Objectives:

1. To explain the basic principle of GPS and its operation.
2. To make the students to understand signal structure, errors, coordinate systems
3. To make the students understand the GPS navigation and observation files and compute the position.
4. Highlight the importance of integrating GPS with other systems.
5. To demonstrate the principle of DGPS and to facilitate the various augmentation systems.
6. To make the students appriciate the signaificance of augmentaion systems.

Course Outcomes:

Student will be able to:

1. Understand the principle and operation of GPS.
2. Frame various coordinate systems for estimating position.
3. Estimate the various errors and their effect on position estimation.
4. Compute user position from Navigation and Observation data formats.
5. Use GPS in various fields such as navigation, GIS etc.
6. Apply DGPS principle and can also analyze various augmentation systems.

UNIT-I

GPS fundamentals

GPS Constellation, Principle of operation, GPS orbits, Orbital mechanics and Satellite position determination, Time references. Dilution of precision: HDOP, VDOP, PDOP & GDOP.

UNIT-II

Coordinate systems

Geometry of ellipsoid, geodetic reference system, Geoid and Ellipsoid and Regional datum. World Geodetic System (WGS-84), Indian Geodetic System (IGS), Earth Centered Inertial (ECI), Earth Centered Earth Fixed (ECEF).

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Various error sources in GPS: Satellite and Receiver clock errors, ephemeris error, Multipath error, atmospheric errors, the receiver measurement noise and UERE.

UNIT-III

GPS measurements

GPS signal structure, SPS and PPS services, C/A and P-code and carrier phase measurement, position estimation with pseudo range measurement, Spoofing and anti-Spoofing, GPS navigation and observation data formats.

UNIT-IV

GPS Applications

Surveying Mapping Marine, air and land Navigation, Military and Space Application. GPS Integration with Geographic Information System (GIS), Inertial Navigation System (INS), Pseudolite and Cellular. Indian Regional Navigation Satellite System (IRNSS).

Differential GPS (DGPS): Principle of DGPS, Types of DGPS: Local Area DGPS (LADPS), Wide Area DGPS (WADGPS).

UNIT-V

GPS Augmentation systems:

Need for augmentation, RNP parameters. Types of augmentation systems: Satellite Based Augmentation system (SBAS): Wide Area Augmentation System (WAAS), GPS Aided GEO Augmented Navigation (GAGAN). Ground Based Augmentation System (GBAS): Local Area Augmentation System (LAAS).

Text Books:

1. Ahmed El-Rabbany, "Introduction to GPS", Artech House Publishers, 2/e, Boston 2006.
2. Elliot D Kaplan and Christopher J Hegarty,"Understanding GPS principles and applications", Artech House Publishers, 2/e Boston & London 2005.

Suggested Reading:

1. B.Hofmann-Wellenhof, H.Lichtenegger, and J.Collins, "GPS Theory and Practice," Springer Verlog, 5/e, 2008.
2. Pratap Misra and Per Enge, "Global Positioning System Signals, Measurement, and Performance," Ganga- Jamuna Press, 2/e, Massachusetts, 2010.
3. Bradford W.Parkinson and James J. Spilker, "Global Positioning system: Theory and Application," Vol.II, American Institution of Aeronautices and Astronautics Inc., Washington, 1996.

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EC 472

REAL TIME OPERATING SYSTEMS

(ELECTIVE –III)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To understand the need of real time operating system.
2. To learn the basic concepts of interprocess communication (IPC).
3. To analyse various scheduling algorithms related to RTOS.
4. To introduce the elementary concepts of Vx works.
5. To study the basic concepts of UNIX operating system.
6. To undetstand the design and development of a target system.

Course Outcomes:

Student 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 a module and understand design issues.
5. Develop a real time embedded system module.
6. Build a user end module.

UNIT-I

Introduction to Real Time Systems

Structures of Operating System (Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures), Operating system objectives and functions, Virtual Computers, Interaction of OS and Hardware architecture, Evolution of operating systems, Batch, multi programming. Multitasking, Multiuser, parallel, distributed and real-time OS.

UNIT-II

Process Management of OS/RTOS

Hard versus Soft Real-Time System: Jobs and Processors, release time, deadlines, and timing constraints, hard and soft timing constraints, hard real-time systems. Uniprocessor Scheduling: Types of scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread scheduling, Multiprocessor scheduling concept, Real Time scheduling concept.

UNIT-III

Real Time Operating System Concepts

Foreground and Background Systems, Shared Resource, Critical section of a Code, Multi Tasking, Task, Context switch, Kernel, Scheduler, Preemptive and non-preemptive kernel, Inter Task Communication: Message Mailboxes, Message queues or pipes and Event flags, Semaphores, Interrupts.

UNIT-IV

Introduction to Vxworks/UNIX OS

Elementary Concepts of VxWorks: Multitasking, Task State Transition, Task Control- Task Creation and Activation, Task Stack, Task Names and IDs, Task Options, Task Information, Task Deletion and Deletion Safety.

Fundamental Concepts of UNIX Operating Systems

Unix Kernel – File system, Concepts of – Process,

Concurrent Execution & Interrupts. Process Management – forks & execution. Basic level Programming with system calls, Shell programming and filters.

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 bootloader.

Text Books:

1. Tanenbaum,"Modern Operating Systems," 4/e, Pearson Edition, 2014.
2. Jane W.S.Liu, Real Time Systems, Pearson Education, Asia, 2001.

Suggested Reading:

1. Jean J Labrosse,"Embedded Systems Building Blocks Complete and Ready-to-use Modules in C" ,2/e, CRC Press ,1999.
2. Karim Yaghmour, Jon Masters, Gilad Ben-Yesset, Philippe Gerum, "Building Embedded Linux Systems", O'Reilly Media, 2008.
3. Wind River Systems, "VxWorks Programmers Guide 5.5", Wind River Systems Inc.2002.

EC 475

DIGITAL IMAGE PROCESSING

(ELECTIVE - III)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To Understand the formation of images are formed and represent digitally.
2. To study transform-domain representation of images.
3. To know the principles of image compression and enhancement .
4. Students would be able to solve the problems related to image restoration.
5. To learn lossy and lossless Compression techniques.

Course Outcomes:

Student will be able to:

1. Understand how images are formed, sampled, quantized and represented digitally.
2. Learn the properties and applications of transforms like Fourier, DCT, Haar, DWT and WHT.
3. Use the principles of image compression, enhancement and segmentation for practical applications.
4. Implement the image restoration techniques on the given image.
5. Remove the redundancy in an image.
6. Implement algorithms of image processing using MATLAB in real time systems.

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," First Indian Reprint 2013, CRC Press, (Taylor & Francis), Yesdee Publications.

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CS 486

OBJECT ORIENTED PROGRAMMING WITH JAVA

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Course Objectives:

1. Write, compile and execute Java programs.
2. Understand the role of the Java Virtual Machine in achieving platform independence.
3. Use threads in order to create more efficient Java programs.
4. Write, compile and execute event driven programming using AWT classes.

Course Outcomes:

1. Design, create, build, and debug Java applications and applets.
2. Create multiple threads for achieving multiple tasks.
3. Write programs using graphical user interface (GUI) components and Java's Event Handling models.
4. Use user defined exception handling to customize any type of errors
5. Create collections to organize objects
6. Use inheritance to reuse objects

Unit-I

Introduction to OOP : Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages ,Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK 1.6.

Programming Constructs : Variables, Primitive Datatypes, Identifiers- Naming Conventions, Keywords, Literals, Operators Binary ,Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control-Branching, Conditional, loops.

Unit-II

Classes and Objects : classes, Objects Creating Objects, Methods, constructors-Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Command line arguments.

Inheritance: Types of Inheritance, Deriving classes using extends keyword, method overloading ,super keyword, final keyword, Abstract class .

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Unit-III

Interfaces, Packages and Exceptions : Interface, Extending interface, Interface Vs Abstract classes, Packages-Creating packages, using Packages, Access protection, java.lang package. Exception -Introduction, Exception handling techniques- try... catch, throws, finally block, user defined exception.

MultiThreading : java.lang.Thread , The main Thread, Creation of new threads, Thread priority, Multithreading- Using isAlive() and join(), Synchronization, suspending and Resuming threads, Communication between Threads.

Unit-IV:

Input/Output : Reading and writing data, java.io package.

Generics and java.util : Generics,Using Generics in Arguments and Return Types, Defining Your Own Generic Classes, Linked List, Hashset Class, Treeset Class, Hashmap Class,Treemap Class, Collections, Legacy Classes and Interfaces, Difference between Vector and Arraylist , Difference between Enumerations and Iterator.

Unit-V:

Applets: Applet class, Applet structure, An Example Applet Program, Applet Life Cycle, paint(),update() and repaint().

Event Handling : Introduction, Event Delegation Moldel, java.awt.event Description, Sources ofEvents, Event Listeners, Adapter classes, Inner classes.

Abstract Window Toolkit: Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons,List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar.

TEXT BOOK:

1. Programming in JAVA,2ed, Sachin Malhotra, Saurabh choudary, Oxford University Press

Suggested Reading:

1. The Complete Reference Java, 8ed, Herbert Schildt, TMH
2. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
3. Object Oriented Programming with JAVA, Essentials and Applications, Raj Kumar Bhuyya,Selvi, Chu TMH
4. Introduction to Java Programming, 7th ed, Y Daniel Liang, Pearson

ME 464

ENTREPRENEURSHIP

(for Mech, Prod, Civil, EEE & CSE)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To understand the essence of Entrepreneurship
2. To know the environment of industry and related opportunities and challenges
3. To know the concept a procedure of idea generation
4. To understand the elements of business plan and its procedure
5. To understand project management and its techniques
6. To know behavioral issues and Time management

Outcomes: After completing this course, students will be able to:

1. Apply the entrepreneurial process
2. Analyze the feasibility of a new business plan and preparation of Business plan
3. Evaluate entrepreneurial tendency and attitude
4. Brainstorm ideas for new and innovative products or services
5. Use project management techniques like PERT and CPM
6. 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”, Tata Me Graw Hill Publishing Company Ltd., 5lh Ed., 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.

IT 429

INTERNET OF THINGS (for ECE)

Instruction	4 L periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Prerequisites: Programming and Problem Solving, Basic Electronics, Computer Organization

Course Objectives:

1. To provide an overview of Internet of Things, building blocks of IoT and the real-world applications
2. To introduce Rasberry Pi device, its interfaces and Django Framework.

Course Outcomes:

After successful completion of the course, student will be able to

1. Understand the terminology, enabling technologies and applications of IoT
2. Learn 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 systemsusing the understanding of the Rasberry Pi board and interfacing sensors and actuators with Rasberry Pi
6. Develop web applications using python based web application framework called Django.

Unit I

Introduction & Concepts: 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 II

Domain Specific IoTs – IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

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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, 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 theRasberry Pi board, Rasberry 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.

Suggested Reading:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014.

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EC 422

SEMINAR

Instruction	3L Periods per week
Sessionals	25 Marks
Credits	1

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of 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. Students are to be exposed to following aspects of seminar presentations.

- Literature survey
- Consolidation of available information
- Power point Preparation
- Technical writing

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.

2. Give twenty(20) minutes presentation through OHP/ PPT/ Slide Projector followed by Ten(10) minutes discussion

3. Submit a report on the seminar topic with list of references and hard copy of the slides.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule should 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 should be from any peer reviewed recent journal publications.

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EC 901

PROJECT

Instruction	6L Periods per week
University Examination	Viva-voce
University Examination	100 Marks
Sessionals	50 Marks
Credits	9

Dealing with a real time problem should be the focus of under graduate project.

All projects will be monitored at least four times in the II-semester through individual presentations (Project batch wise).

Every student should maintain a project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Sessional marks should be based on the marks, awarded by a project monitoring committee of faculty members as well as the marks given by the guide.

Common norms are established for final documentation of the project report, the students are directed to download from the website regarding the guidelines for preparing the project report and the project report format.

The project report shall be evaluated for 100 Marks by the External Examiner.

If the project work found inadequate in the end examination, the candidate should repeat the project work with a new problem or improve the quality of work and report it again.

Break up for 100 Marks in the end examination:

1. Power point presentation 20 Marks
2. Thesis/Report preparation 40 Marks
3. Viva-voce 40 Marks

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16ECC101

DATA AND COMPUTER COMMUNICATION NETWORKS

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of Digital communication is required

Course Objectives:

The main objective of this course is that the student shall develop an understanding of the underlying structure of the data and communication networks with special emphasis on the following concepts:

1. Fundamental concepts of computer networking like protocols, structured architecture models and topologies;
2. Link control concepts of flow and error control, switching concepts of circuit switching, packet switching, ATM etc., SS7.
3. Working of network components like Bridges, switches ; routing concepts and routing strategies; Network management, transport and application layer concepts

Topics Covered:

UNIT – I

Data Communications Model, communication Tasks, basic concepts of Networking and Switching, Line/Networking configurations; Protocols and Architecture, PDU, OSI and TCP/IP Architectures, Comparisons between OSI and TCP/IP; Flow Control, Sliding Window Flow Control, Error control, ARQ Protocols.

UNIT – II

Data Link Control, Bit stuffing, HDLC frame format, HDLC Modes and Operation; Circuit Switching concepts, Circuit SwitchElements, Three Stage Blocking type Space Division Switch, Time Division Switching; Packet Switching, Datagram and Virtual Circuit switching Principles, Effects of variable packet size.

UNIT – III

Control Signaling Functions, In Channel Signaling, Common Channel Signaling, Introduction to Signaling System Number 7 (SS7); X.25, X.25 Protocol Control Information; Routing, Routing in Packet Switched Networks and Routing Strategies; LAN Architecture, Topologies, Choice of Topology, Ring and Star Usage, MAC and LLC, Generic MAC Frame Format; Hubs, Two Level Star Topology, Layer 2 Switches.

UNIT – IV

Bridge, Bridge Operation, Bridges and LANs with Alternative Routes, Spanning Tree, Loop resolution in bridges; Internetworking; Internet Protocol, IP address, IPv4, IPv6 comparison; Transport layer protocols, UDP Operation, TCP features, TCP/IP Addressing Concepts, Credit based Flow Control, Error Control and Congestion Control.

UNIT – V

Wireless LAN, IEEE 802.11 Architecture, IEEE 802.11- Medium Access Control logic; ATM, features and Architecture of ATM, Quality of Service in ATM; Security in the Internet, IP Security, Firewalls; Network Management System, SNMP.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Explain the importance of data communications and each of the Computer Networks related communication protocols in a structured architecture.
2. Analyze the services and features at various layers of data communication network architecture such as switching methodologies, flow and error control mechanisms etc.
3. Select appropriate routing strategies and congestion control algorithms for various networks.
4. Distinguish the operation of UDP & TCP and IPV 4 and IPV6 in terms of features and concepts.
5. Analyze the features and operations of various technologies like ATM, ISDN and applications like Mail Transfer, network management etc.

Suggested Reading:

1) William Stallings, “Data and Computer Communications”, Ninth Edition, Pearson Prentice Hall, 2011.
2) Behrouz A. Forouzan, “Data Communications and Networking”, Fourth Edition, Tata Mc Graw Hill, 2007.

16ECC105

PROBABILITY AND RANDOM PROCESSES

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge about probability and random variables is required.

Course Objectives:
Upon successful completion of the course, students will be able to:

1. Apply the knowledge of probability, random variables and random processes gained in this course to several complex engineering problems.
2. Model a random variable / process into a mathematical model. Compute probability distributions and estimate statistical / time variations
3. Identify a random signal, obtain the autocorrelation and PSD. Also able to estimate the response of a linear system to a random process such as noise.

Topics Covered:

UNIT I
Probability and distribution: Joint and conditional probability, independent events, Combined sample space, events in the combined space, probabilities in combined experiments, concept of random variables, distribution and density functions: Binomial, Poison, Uniform, Exponentia, Gaussian, and Rayleigh distributions. Conditional distribution and density functions.

UNIT II
Operations in Random Variables: Expectation, moments, Chebychev's inequality and Markov's inequality. functions that give moments, characteristic functions, moment generating function, transformation of a random variable, computer generation of one random variable, vector random variables, joint distribution and joint density properties, condition distribution and density, statistical independent, sum of several variables, central limit theorem: unequal distribution, equal distribution.

UNIT III
Multiple Random Variables and Processes: Expected value of a function of Random variables, Joint moments about the origin, joint central moments, joint characteristic functions, jointly Gaussian random variables and properties, Linear transformation of Gaussian Random Variables. Sampling and Limit theorems: estimation of Mean, Power and Variance. Complex random variables.

UNIT IV
The random process and spectral characteristics: concept, stationarity and independence, correlation functions, complex random processes.

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Spectral Characteristics of Random Processes: Power density spectrum and its properties. Relationship between power spectrum and auto correlation function. Cross power density spectrum and its properties, Relationship between cross power spectrum and cross correlation.

UNIT V

Linear System with Random Inputs: Random signal response of linear systems, auto correlation of response and cross correlation functions of input and out put. System evaluation using random noise. White and colored noise. Spectral characteristic of a system response. Noise band width, band pass, band limited processes and narrow band processes, properties of band limited processes. Modeling of noise sources, an antenna as noise source.

Course Outcomes:

Upon the completion of the course, the student will be able to

1. Understand the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.
2. Characterize probability models and function of random variables based on single & multiples random variables.
3. Evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits.
4. Demonstrate the specific applications to Poisson and Gaussian processes and representation of low pass and band pass noise models.
5. Apply the theory of random processes to signal processing and communications systems and characterize systems by analyzing random process response.

Suggested Reading:

1. Peyton Z. Peebles JR., "Probability Random Variables and Random Signal Principles", Tata Mc Graw Hill, edition, 4/e, 2002.
2. Athanasios Papolis, "Probability, Random Variables and Stochastic Processes", McGraw Hill, Inc., 3rd edi., 1991.
3. Stark, "Probability & Random Process with Application to Signal Processing", Pearson Education, 3rd edition, 2002.

16ECC106

CODING THEORY AND TECHNIQUES

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites:

A good background of mathematics including matrices, probability theory is expected and the student must have completed the related courses including Digital Communications, Information Theory and Source coding.

Course Objectives:

1. To study the various algorithms and compare bit error rate for different systems.
2. To develop an understanding of the underlying mathematical structure and algorithms different codes and how they applicable.
3. To study and analyze the real time applications of each coding technique.

Topics Covered:

UNIT – I
Introduction:
Digital communication system, Wireless channel statistical models, BER performance in AWGN and fading channels for different modulation schemes, BER performance of CDMA, FH – CDMA in AWGN and fading channels, capacity of fading channels with CSI, Diversity reception, channel coding Theorem, Channel coding gain.

UNIT – II
Block Coding:
Galois fields, polynomials over Galois fields, RS codes, Decoding Techniques for RS codes, LDPC encoder and decoder, Performance analysis of RS and LDPC codes. BCH codes.

UNIT – III
Convolution codes:
Linear convolution encoders, Structural properties of Convolution codes, Viterbi decoding technique for convolution codes – Soft / Hard decision, concatenation of block codes and convolutional codes, performance analysis, concept of Trellis coded modulation.

UNIT – IV
Turbo Codes:
Parallel concatenation, Turbo encoder, Iterative decoding using BCJR algorithm, Performance analysis.

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UNIT – V

Space – Time Coding:

MIMO systems, MIMO fading channels, rate gain & diversity gain, transmit diversity, Alamouti scheme, OSTBC codes, Linear space – time codes, trellis space – time codes, Space – time codes with no CSI

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop mathematical model for various types of wireless channels and assess Channel capacity and information rates.
2. Able to apply linear algebra, concept of Galois field, conjugate roots, minimal polynomial in channel coding techniques for error control.
3. Explain Structural, Distance properties and analyze efficient decoder algorithms of Convolutional codes.
4. Explore efficient design methods and the powerful soft iterative decoding techniques for high capacity codes like LDPC codes and Turbo codes
5. Understand and appreciate the use of Alamouti codes, Space-time block codes & Space-time trellis codes.

Suggested Reading:

1. S.B. Wicker, Error control systems for Digital communication and storage, Prentice-hall 1995.
2. E. Biglieri, Coding for Wireless Channels, Springer,2007.
3. K.L.Du & M.N.S.Swamy, Wireless Communication Systems: From RF Subsystems to 4G Enabling Technoligies, Cambridge,2010.
4. J.G. Proakis & M. Salehi, Digital Communications, Mc Graw-Hill, 2008.

16ECE105

SATELLITE AND MICROWAVE COMMUNICATIONS

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of satellite communication is required

Course Objectives:

1. To acquire the essential knowledge to understand CCITT modulation plans, units for power calculations, Noise calculations.
2. To explain the students about LOS propagation, Link engineering, path and link reliability, Tropospheric scatter communication system.
3. To get the concepts of Earth station technology, V-SAT, GIS and GPS.

Topics Covered:

UNIT I

Introductory concepts: Transmission problem, simplified transmission system, the decibel and basic derived decibel unit, Neper, practical transmission, speech, SNR, Noise figure and noise temperature, EIRP and conversion factors, CCITT modulation plan, loading of FDM system, pilot tones, noise calculation, through super group techniques, compandors, characteristics of carrier equipment.

UNIT II

Line-of-sight communication systems: Link engineering, propagation characteristics in free space, path calculations, feeding, diversity reception, noise power ratio and its measurements, frequency planning. Path and link reliability, rainfall and other precipitation attenuation, radio link repeaters, antenna towers and masts, plain reflectors as passive repeaters, noise planning on radio links.

UNIT – III

Tropospheric scatter communication system: Introduction, phenomenon of tropospheric scatter, tropospheric fading, path loss calculations, aperture to medium coupling loss take of angle, equipment configuration, isolation, inter modulation, typical tropospheric scatter parameters. Frequency assignment. Earth station technology: The satellite earth space window, path loss considerations of the up link and down path calculations.

UNIT- IV

Earth station, G/T, C/N , link calculation, C/N for the complete link, and design of communication systems via satellites, Modulation, Multiplexing and multiple access techniques: TDMA,FDMA, CDMA,SSMA, SPADE.

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UNIT – V

Reliability, Redundancy, Quality assurance, Echo control and Echo suppression, introductory concepts of VSATS, GIS, GPS and Future trends, Pay load engineering – Definition, constraints, specification and configurations.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Acquire fundamental knowledge of CCITT modulation plans, power and noise calculations.
2. Analyze LOS propagation system and calculate the path and link reliability.
3. Understand and compare the Tropospheric communication system and also the concepts of Earth station Technology.
4. Calculate G/T and C/N ratios of a path link.
5. Understand the basic concepts of VSAT, GIS, GPS and payload engineering.

Suggested Reading:

1. Roger L Free man, "Telecommunication transmission handbook", John Wiley, 4th Edition, 1998.
2. T.Pratt & C.W. Bostian, "Satellite Communication Systems", PHI, 1st edition,1986.
3. B.G.Evans, Satellite communication system edited, 3rd edition, IET, U.K., 2008.
4. Dennis Roddy, "Satellite Communication Systems", Mc Graw Hill publications, 4th Edition, 2006.
5. Wayne Tomasi "Advanced Electronics Communication System" Pearson Education, 6thEdt, Apr 2003.

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16ECE102

GLOBAL NAVIGATION SATELLITE SYSTEMS

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Pre-requisite: A prior knowledge of Satellite Communication, Radio Navigation Aids and INS is required.

Course Objectives

1. To explain the basic principles of various positioning techniques and introduce GPS operating principle.
2. To make the students to understand the essential features such as signal structure, errors, coordinate systems etc., and highlight the importance of integrating GPS with other systems.
3. To teach the necessity of augmentation of GPS and discuss SBAS and GBAS systems.

Topics Covered:

UNIT 1

GPS fundamentals: INS, Trilaiteration, Hyperbolic navigation, Transit, GPS principle of operation, architecture, operating frequencies, orbits, Keplerian elements.Solar and Siderial days, GPS and UTC Time.

UNIT 2

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 3

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 4

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 5

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Other Constellations and Augmentation systems Other satellite navigation constellations GLONASS and Galileo IRNS System. : Relative advantages of SBAS and GBAS, Wide area augmentation system (WAAS) architecture, GAGAN, EGNOS and MSAS. Local area augmentation system (LAAS) concept.

Course Outcomes

1. Students will understand various data formats obtained from GNSS signals.
2. Students will be able to calculate satellite and user position.
3. Students will be able estimate the contribution of each error
4. Students are expected to estimate the GNSS positional accuracy.
5. Students will understand the concepts of Global and Regional Navigation and Augmentation systems developed by other nations.

Suggested Reading:

1. B.Hofmann Wollenhof, H.Lichtenegger, and J.Collins, "GPS Theory and Practice", Springer Wien, new York, 2000.
2. Pratap Misra and Per Enge, "Global Positioning System Signals, Measurements, and Performance," Ganga-Jamuna Press, Massachusetts, 2001.
3. Ahmed El-Rabbany, "Introduction to GPS," Artech House, Boston, 2002.
4. Bradford W. Parkinson and James J. Spilker, "Global Positioning System: Theory and Applications," Volume II, American Institute of Aeronautics and Astronautics, Inc., Washington, 1996.

16ECE111

EMBEDDED SYSTEM DESIGN

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisite: A prior knowledge of Microprocessors-Microcontrollers and basics of operating Systems is required.

Course Objectives:

1. To learn the fundamentals of the embedded system design
2. To understand RTOS environment in embedded system
3. To analyze various embedded applications and debugging tools

Topics Covered:

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.

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).

Course Outcomes:

Students will be able to

1. Choose appropriate processor for an Embedded System application.
2. Understand various Serial communication protocols like IIC, CAN.
3. Understand inter process communication techniques for multiprocessing.
4. Know different Real Time Task Scheduling algorithms.
5. Develop and Debug various embedded system applications.

Suggested Reading:

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.
4. David.E. Simon, "An Embedded Software Primer", Pearson Edition, 2009.
5. Andrew N.sloss, Dominic Symes, Chris Wright, "ARM System Developer's guide", Elsevier publications 2005.

16ECC107

COMMUNICATIONS LAB

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of Digital communication is required.

Course Objectives:

The main objective of this course is that the student shall develop an understanding of the underlying concepts of communication systems with special emphasis on the following concepts:

1. Fundamental modulation schemes and Synchronous and asynchronous serial data communication.
2. Study of noise figure and error coding.
3. Establishing a simple optical fiber communication link.

List of Experiments Covered:

1. Study of Phase Shifter, Multiplier and Integrate and Dump Filter
2. Measurement of noise figure
3. Analysis of error coding, parity check and hamming check.
4. Study of wavelength division multiplexing and de-multiplexing.
5. Establishment of Analog / Digital links on optical fibre communication systems, study of 4 channel TDM on optical fibre link
6. Serial communication using RS 232C / Standard Asynchronous / Synchronous model
7. Characterization of Optical directional coupler.
8. Study of modulation schemes using Spectrum analyzer.
9. Simulation of Analog and Digital Communication Modulators / Demodulators using MATLAB and SIMULINK.
10. Simulation of Channel coding / decoding using MATLAB and SIMULINK

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Experiments on TMS320 C6748 Processor using CCS

11. Familiarity with CCS-Creation, debugging and running a project

12. Implementation of convolution and correlation

13. Implementation of Decimation and Interpolation

14. Implementation of FFT

15. Implementation of FIR and IIR filters

Course Outcomes:
Upon completion of this course, the student will be able to

1. Able to apply suitable modulation schemes and coding for various applications.
2. Examine the Analog / Digital links on optical fibre communication systems, study of 4 Channel TDM on optical fibre link.
3. Utilize the Optical directional coupler and Spectrum analyzer.
4. Develop the simulation models for different modulation schemes and perform channel Coding using MATLAB and SIMULINK.
5. Perform the Experiments on TMS320 C6748 Processor using CCS.

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16ECC109

SEMINAR - 1

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of any Subject in Communication Engineering (related to the seminar topic) is required.

Course Objectives:

1. Awareness of how to use values in improving own professionalism
2. Learning about personal and communication styles
3. Learning management of values for personal and business development

Oral presentation and technical report writing are two important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in the advanced fields of Communication Engineering and related topics.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects for a seminar presentation.

- Literature survey
- Organization of the material
- Presentation of OHP slides / LCD presentation
- Technical writing

Each student required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes time for presentation following by a 10 minutes discussion.
3. Submit a detailed technical report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule shall not be entertained.

For award of sessional marks, students are to be judged by at least two faculty members on the basis of an oral and technical report preparation as well as their involvement in the discussions.

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Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Demonstrate effective writing skills and processes by employing the rhetorical techniques of academic writing, including invention, research, critical analysis and evaluation, and revision.
3. Effectively incorporate and document appropriate sources in accordance with the formatting style proper for the discipline and effectively utilize the conventions of standard written English.
4. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids.
5. Deliver well-rehearsed and polished presentations meeting time, content, and interactive requirements.

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SOFT SKILLS

16 EG 104

Instruction	2 Hours per week	End Exam- Duration	-
Sessionals	Satisfactory/Unsatisfactory	End Exam- Marks	-

Prerequisite for the Course: - The students should be graduates with basic English proficiency and possess knowledge of both verbal and non-verbal communication skills.

Course Objectives:
To help the students

1. Participate in group discussions and case studies with confidence and to make effective presentations. To equip them with resume packaging, preparing and facing interviews.
2. Build an impressive personality through effective time management, leadership, self-confidence and assertiveness.
3. Understand what constitutes proper grooming and etiquette in a professional environment. To be competent in verbal aptitude.

Exercise 1
Group Discussion & Case studies – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
Elements of effective presentation – Structure of presentation – Presentation tools – Body language
Creating an effective PPT

Exercise 2
Interview Skills – Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets
Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

Exercise 3
Personality Development – Effective Time Management, assertiveness, decision making and problem solving, stress management, team building and leadership.

Exercise 4
Corporate Culture – Grooming and etiquette, corporate communication etiquette.
Academic ethics and integrity

Exercise 5
Verbal Aptitude – Sentence correction, sentence completion, jumbled sentences and vocabulary. Reading comprehension.

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Course Outcomes:

The 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. Correct and complete sentences, have a good vocabulary and comprehend passages confidently

Suggested Reading:

1. Leena Sen , “Communication Skills”, Prentice-Hall of India, 2005
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. Covey and Stephen R, “The Habits of Highly Effective People”, New York: Free Press, 1989

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16ECC102

MODERN DIGITAL SIGNAL PROCESSING

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of Signals and systems is required.

Course objectives:
1. To design FIR and IIR filters.
2. To understand multi rate signal processing techniques and filter banks.
3. To learn Wavelet Transforms and its advantages compared to STFT.

Topics Covered:

UNIT I
Digital filters: Review of FIR and IIR filters, Optimal FIR filters Spectral or frequency transformation of IIR filters, cascaded and lattice structures of FIR and IIR filters, Comparison of FIR and IIR filters.

UNIT II
Multirate signal processing – Decimation by a integer factor , Interpolation by a integer factor , Sampling rate conversion by a rational factor , Design of practical sampling rate converters, Software implementation of sampling rate converters, Applications of Multirate signal processing.

UNIT III
Digital filter banks and Transmultiplexers: Digital filter banks, Maximally decimated DFT filter banks, Transmultiplexers, applications of transmultiplexers to digital communications modulation.

UNIT IV
Maximally decimated filter banks: Two- channel quadrature mirror filter banks, L–channel QMF banks, multi level filter banks, Two channel perfect reconstruction conditions, Design of perfect reconstruction filter banks with real coefficients, lattice implementation of orthonormal filter banks, application to an audio signal.

UNIT V
Introduction to wavelet transforms – Short time Fourier transform, Gabar transform, wavelet transform, Recursive multi resolution Decomposition, Haar wavelet, Digital filter implementation of the Haar wavelet, Digital Filtering interpretation.

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Course Outcomes:

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

1. Design and implement the required filter for the given specifications.
2. Analyze the given signals using multirate techniques.
3. Design and implement trans multiplexers.
4. Design QMF filter banks and M channel digital filter banks.
5. Analyze the signal using wavelet transforms.

Suggested Reading:

1. Proakis, JG and Manolakis, DG, 'Digital Signal Processing', PHI, 4th ed., 2006.
2. Roberto Cristi, Modern Digital Signal Processing, Thomson Books, 2004.
3. SK Mitra, Digital Signal Processing, TMH, 2006.
4. Emmanuel C. Ifeachor and Barrie W. Jervis, 'Digital Signal Processing- A practical approach, 2nd edition, Pearson Education, 2004.

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16ECC103

DETECTION AND ESTIMATION THEORY

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of Digital signal processing is required.

Course Objectives:

1. To provide hypothesis testing, estimation and detection background for engineering applications.
2. To introduce the methods of detection and estimation techniques under different types of noises.
3. To impart knowledge about various filtering techniques such as K-B, W-K.

Topics Covered:

UNIT I

Elements of Hypothesis Testing: Introduction, Baye's Hypothesis Testing, Minimax Hypothesis Testing, Neyman – Pearson Hypothesis Testing and Composite hypothesis testing.

UNIT II

Signal Detection in Discrete Time: Models and Detector structures, Detection of deterministic signals in independent noise, Detection of deterministic signals in Gaussian noise. Detection of signals with random parameters. Detection of stochastic signals. Performance evaluation of signal detection procedures.

UNIT III

Elements of Parameter Estimation: Bayesian Parameter Estimation, MMSE, MMAE and MAP estimations. Non random parameter estimation. Exponential families, completeness theorem for exponential families. The information inequality. Maximum likelihood Estimation (MLE). Asymptotic normality of MLE's

UNIT IV

Elements of Signal Estimation: Introduction, Kalman – Bucy filtering. Linear estimation, Orthogonality Principle. Wiener – Kolmogrov filtering; Causal and non-causal filters.

UNIT V

Signal Detection in Continuous Time: Detection of deterministic and partly determined signals in Gaussian noise; Coherent detection. Detection of signals with unknown parameters.

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Course Outcomes:

Upon completion of course the students will able to learn

1. Classical and Bayesian estimation approaches.
2. Learn detection of signals in different types of noises. Detection of stochastic signals and performance evolution of detection procedures in discrete-time.
3. Learn about elements of parameter estimation such as Bayesian parameters estimation, MMSE estimation and maximum likelihood estimation etc.
4. Learn about elements of signal estimation techniques like Kalman-Bucy filtering, Wiener-Kolmogrov filtering, causal and non-causal filters etc.
5. Learn about detection of signals with unknown parameters. Coherent detection etc. in continuous time.

Suggested Reading:

1. H.V. Poor, "An Introduction to Signal Detection and Estimation", Springer – Verlag, 2nd edition, 1994.
2. M.D. Srinath & P.K. Rajasekaran, "An introduction to statistical signal processing with applications", Prentice Hall, 2002.
3. H.L. Vantrees, "Detection, Estimation & Modulation Theory", Part-I, John Wiley & Sons, 1968.

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16ECC104

WIRELESS MOBILE COMMUNICATION SYSTEMS

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of Analog and Digital Communication Systems is required.

Course Objectives:

To introduce the knowledge of the following mobile and wireless communication concepts and technologies along with their applications to the students such as

1. The concepts of frequency reuse, handoff, channel assignment, interference and system capacity enhancement.
2. Methods to estimate large scale path loss and received signal strength in case of various outdoor and indoor wireless propagation conditions.
3. The concepts of small scale fading due to multipath, Doppler Effect, signal and channel bandwidth conditions.

Topics Covered:

UNIT I

Modern Over View wireless communication systems: 1G, 2G, 2.5G, 3G and 4G technologies WLL, WLAN, PAN and Bluetooth.

Cellular Concept: Frequency reuse, Channel assignment strategies, handoff strategies.

UNIT II

Interference and system capacity, near end and far end interference, effect of near end mobile units. Grade of service, improving coverage and capacity in cellular systems.

UNIT III

Mobile radio propagation : large scale propagation free space propagation model. Outdoor propagation models: longely Rice model, Durkin's model, A case study, okumura model, Hata model, PCS Extension to Hata model. Indoor propagation models: partition losses(same floor), partition losses(between floors), log distance path loss model, ericsson multiple breakpoint model, attenuation factor model, signal penetration into buildings.

UNIT IV

Small scale fading & multipaths: Factors influencing small scale fading, small scale multipath measurements, parameters of mobile multipath channel. Types of small scale fading. Spread Spectrum techniques,Multiple Access techniques: FDMA, TDMA, CDMA, CDMA Cellular radio networks.

UNIT V

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Modulation techniques for mobile radio, constant enevelop modulation AMPS, and ETACS, GSM.Intelligent network for wireless communication advanced intelligent network (AIN), SS7 network for ISDN & AIN. Wireless ATM networks.

Course Outcomes:

Upon the completion of the course, the student will be able to

1. Distinguish the major cellular communication standards (1G/2G/3G/4G systems)
2. Appreciate the tradeoffs among frequency reuse, signal-to-interference ratio, capacity, and spectral efficiency
3. Analyze large-signal path loss and shadowing and compare different outdoor and indoor propagation models.
4. Distinguish the merits and demerits of TDMA, FDMA and CDMA technologies used for mobile cellular communication.
5. Apply different modulation techniques to various wireless communication and networks.

Suggested Reading:

1. Rappaport, "Wireless Communication", Pearson Education, 2nd edition, 2002.
2. William C. Y. Lee, "Mobile Cellular Telecommunications: Analog and Digital Systems", 2nd edition, McGraw-Hill Electronic Engineering Series, 1995.
3. William C.Y. Lee, "Mobile Communication Engineering", Mc-Graw Hill, 1997.
4. Mike Gallegher, Randy Snyder, "Mobile Telecommunications Networking with IS-41", McGraw Hill 1997.
5. Kernilo, Feher, "Wireless Digital Communications", PHI, 2002.

16ECE106

OPTICAL FIBRE COMMUNICATION SYSTEMS

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of basics of communication is required.

Course Objectives:

1. To understand the basic elements of optical fiber transmission link, fiber modes configurations and the different kind of losses, signal distortion in optical wave guides and other signal degradation factors
2. To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes, PIN APD diodes, noise performance in photo detector, receiver operation and configuration
3. To learn the application of optical fibre in Local Area Networks and operational principles of WDM.

Topics Covered:

UNIT I

Optical Fibres: Fibre Structures, Wave-guiding and fabrications, Nature of light, Basic optical laws and definitions, Modes and configurations, Mode theory of circular wave guides, Single, Multi mode step index and Graded index Fibres , Fibre materials and fabrication. Attenuation, Dispersion, Signal distortion in optical wave-guides, Mode coupling, Design optimization of single mode couplers.

UNIT II

Optical Sources & Detectors: Semiconductors as optical Sources and their fabrication. LED and Laser diodes, Linearity of sources, Modal, Partition and reflection noise, Power launching and coupling. Physical principles of PIN and APD, Photo detector noise, detector response time, Avalanche multiplication noise, Temperature effect on avalanche gain, Photo diode materials.

UNIT III

Optical Fibre communication: Basic communication system, Fundamental receiver operation, Digital receiver performance calculations. Preamplifiers types, Analog receivers.Fibre Links: Point to point links, Line coding, Eye pattern, Noise effects on digital transmission system performance. Overview of analog links, Carrier noise ratio in analog systems. Power budget, Time budget, Maximum link length calculations.

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UNIT IV

Opto-Electronic Integrated Circuits (OEICs): Basic concepts of OEICs. Optical Planar and Strip waveguides. Principles of Electro-Optic Effect. Guided wave devices – Phase modulator, Mach-Zehnder Interferometer modulator and switch, Optical directional coupler and switches.

UNIT V

Multi channel transmission techniques, Classification of coherent optical Fibre systems, Modulation techniques, polarization control requirements, WDM. Application of optical Fibre in Local Area Networks, Introduction of optical amplifiers.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Demonstrate the Optical fiber communication and classify fiber modes configurations and Structures.
2. Evaluate the Power Launching and coupling, Lensing schemes.
3. Distinguish the fiber optical receivers such as PIN APD diodes and examine the noise performance in photo detectors
4. Calculate the system bandwidth, noise, probability of error and maximum usable bit rate of a digital fibre system and system link loss.
5. Apply the multi-channel transmission techniques and optical fiber in LANs.

Suggested Reading:

1. Djafar K.mynbaev Lowell l.Scheiner "Fibre Optic Communications Technology", Pearson Education Asia.
2. Senior John M. "Optical Fibre Communications Principles and Practice", Prentice Hall India, second edition, 1996
3. Keiser Gerd , "Optical Fibre Communications", Mc GrawHill, second edition, 1991.

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16ECE113

SOFTWARE DEFINED AND COGNITIVE RADIO

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of signal processing, Communication and spectral knowledge is required.

Course Objectives:

1. To make the students understand the difference between Superhetrodyne Radio and Software defined Radio (SDR).
2. To differentiate between Cognitive Radio (CR) and SDR and study their architectures.
3. To make the students know about the CR signal processing Techniques and applications.

Topics Covered:

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, Power Consumption Issues, Calibration Issues, Projects and Sources of Information on Software Defined Radio,

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, Derivation of Minimum Power Consumption, Power Consumption Examples, ADC Performance Trends, 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, Partial Reconfiguration, Host Interface, Memory-Mapped Interface to Hardware, Packet Interface, Architecture for FPGA-Based SDR, Configuration, Data Flow, Advanced Bus Architectures, Parallelizing for Higher Throughput,

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Hybrid and Multi-FPGA Architectures, Hardware Acceleration, Software Considerations, Multiple HA and Resource Sharing, Multi-Channel SDR.

UNIT IV

Cognitive Radio : Techniques and signal processing History 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, cyclostationary and wavelet based sensing- problem formulation and performance analysis based on probability of detection vs SNR. Cooperative sensing: different fusion rules, wideband spectrum sensing- problem formulation and performance analysis based on probability of detection vs SNR.

UNIT V

Cognitive Radio: Hardware and applications: Spectrum allocation models. Spectrum handoff, Cognitive radio performance analysis.Hardware platforms for Cognitive radio (USRP , WARP), details of USRP board, Applications of Cognitive radio

Course Outcomes:

1. The students would learn the difference between the super hetrodyne receiver, Software Defined Radio and Cognitive Radio.
2. The different architectures of SDR and CR would be learnt by the student.
3. The various spectrum sensing methods should be understood.
4. Various signal processing techniques of CR would be known.
5. The facilities available in USRP and WARP boards are known.

Suggesting Reading:

1. "RF and Baseband Techniques for Software Defined Radio" Peter B. Kenington, ARTECH HOUSE, INC © 2005.
2. "Implementing Software Defined Radio", Eugene Grayver, Springer, New York Heidelberg Dordrecht London, ISBN 978-1-4419-9332-8 (eBook) 2013.
3. "Cognitive Radio Technology", by Bruce A. Fette, Elsevier, ISBN 10: 0-7506-7952-2, 2006.
4. "Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems", Hüseyin Arslan, Springer, ISBN 978-1-4020-5541-6 (HB), 2007.

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16ECE119

SELECTED TOPICS IN STRATEGIC ELECTRONICS

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Prerequisites: A prior knowledge of Radar Engineering, communication and antenna concepts are required

Course Objectives

1. To explain the concepts of electronic intelligence using the fundamentals of radar and simple localization techniques along with appropriate mathematical analysis necessary for solving new problems.
2. To teach the position fixing techniques and communication EW systems along with standard methods for electronic jamming.
3. To present the concepts of DF antennas and shared aperture arrays necessary for complete understanding of both ELINT and COMINT systems.

Topics Covered:

UNIT – I: Electronics Intelligent

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, Direction Finding, Instantaneous Direction Finding.Amplitude Comparison AOA Measurement, Phase Interferometers, Bearing Discriminators. Short Baseline TDOA for AOA.

UNIT – II: Emitter Location

Introduction, Emitter Location Estimation, Deriving the Location Covariance Matrix. Angle of Arrival Location Analysis, Time Difference of Arrival Location Analysis, Time/Frequency Difference of Arrival Location Analysis. Geometric Dilution of Precision, Incorporation of Measurement Error.

UNIT – III: **Position – Fixing Techniques**

Position – fixing algorithms: Eliminating Wild Bearings, Stansfield Fix Algorithm, Mean-Squared Distance Algorithm. Single-site location techniques: Fix accuracy, GDOP and fix coverage. Time

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difference of Arrival: Position-Fixing using TDOA Measurements, GDOP.Differential Doppler, Position-Fix Accuracy. Time of Arrival.

UNIT–IV: Communication EW Systems and Techniques for Electronic Jamming

Introduction, Information warfare, Electronic warfare: Electronic support, Electronic attack, Electronic Protect.Electron support: Low probability of detection/interception/exploitation.Typical EW System Configuration.Electronic attack: Introduction, Communication jamming, jammer deployment, narrow band / partial-band jamming, barrage jamming, follower jammer, jamming LPI targets.A General Description of the Basic Elements of Electronic Jamming. Mathematical Models of Jamming Signals: Fundamental Principles.

UNIT – V:DF Antennas and Shared aperture arrays

Omni-Directional Antennas: Omni-Directional Antenna Applications, Parameters for Omni-Directional Antennas, Directional Intercept Antennas. Linear arrays: Uniformly spaced line source of equal amplitude, array grating lobes, Beam width and band width of phased arrays. Array directivity, array SNR gain, mutual coupling between antenna elements.Electronic warfare arrays, Shared aperture arrays: the arguments for systems integration, the case for shared aperture systems, the case for independent systems and the ideal shared aperture arrays.

Course Outcomes

1. Students will be able to understand various parameters of Radar signals
2. Students will be capable of understanding the intricacies of any ELINT system
3. Students will be able to mathematically estimate emitter locations for simple cases
4. Students will be able to estimate the position of the COMINT system
5. Students will understand the concepts of antennas and should be able to tell which type of antenna is suitable for either ELINT or COMINT systems.

Suggested Readings:

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, 2008, Artech house, Inc.
3. Sergei A. Vakin, Lev N. Shustov, Robert H. Dunwell “Fundamentals of Electronic Warfare”, 2001, Artech House, Inc.
4. Nicholas Fourikis, “Advanced array systems, Applications and RF technologies, 2005, Academic Press.

16ECC108

COMPUTER COMMUNICATION NETWORKS LAB

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of Data and Computer Communication Networks is required.

Course Objectives:

The main objective of this course is that the student shall develop an understanding of the underlying structure of the data and communication networks with special emphasis on the following concepts:

1. Fundamental concepts of computer networking like Stop & Wait protocol, Go to back N-protocol, Selective Retransmission protocols.
2. Concepts of Data encryption in data communication networks, Network Management and wireless LAN
3. Working of IEEE standards like token bus (IEEE 802.4 standard) and token ring (IEEE 802.5 standard)

List of Experiments Covered:

1. Data communication protocols
   a) Stop & Wait protocol
   b) Go to back N-protocol
   c) Selective Retransmission
2. PC to PC file transfer
3. Error detection codes in data communications
4. Study of LAN fundamentals
5. Data encryption in data communication networks
6. Point – to – Point communication in communication networks
7. Multicast / Broadcast communication
8. Study of Token bus – IEEE 802.4 standard

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9. Network / Token management

10. Client Sever Simulation

11. Study of wireless LAN

Experiments on Embedded Applications

12. Design and development of embedded application by using serial communication protocols (7-segement display, ADC and DAC)

13. Design and development of ARM based wireless embedded networking Applications (GSM, GPS and Zigbee)

14. Implementation of multitasking by using Vx-Works IDE

15. Implementation of IPC by using Vx-Works IDE

Note: The experiments will be decided and modified if necessary and conducted by the lecture concerned.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Analyze network performance through simulation.
2. Simulate a client server system and analyze data flow characteristics.
3. The course also includes a short introduction to Data encryption in data communication networks.
4. Configure a wireless LAN and compare its working with respective to a wired LAN.
5. Design and develop ARM (Micro controller) based wired and wireless networking applications.

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16ECC110

SEMINAR - 2

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of any Subject in Communication Engineering (related to the seminar topic) is required.

Course Objectives:

1. Awareness of how to use values in improving own professionalism
2. Learning about personal and communication styles
3. Learning management of values for personal and business development

Oral presentation and technical report writing are two important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in the advanced fields of Communication Engineering and related topics.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects for a seminar presentation.

- Literature survey
- Organization of the material
- Presentation of OHP slides / LCD presentation
- Technical writing

Each student required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes time for presentation following by a 10 minutes discussion.
3. Submit a detailed technical report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule shall not be entertained.

For award of sessional marks, students are to be judged by at least two faculty members on the basis of an oral and technical report preparation as well as their involvement in the discussions.

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Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Demonstrate effective writing skills and processes by employing the rhetorical techniques of academic writing, including invention, research, critical analysis and evaluation, and revision.
3. Effectively incorporate and document appropriate sources in accordance with the formatting style proper for the discipline and effectively utilize the conventions of standard written English.
4. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids.
5. Deliver well-rehearsed and polished presentations meeting time, content, and interactive requirements.

16ECC111

MINI PROJECT

Instruction		End Exam- Duration	-
Sessionals	--	End Exam- Marks	-

Prerequisite for the Course: - The Student s should have a prior knowledge of the core courses under curriculum.

Course Objectives:

Students are expected to:

1. Practice and experience the literature survey on the chosen field / topic.
2. Able to formulate the scope of the mini project.
3. Use simulation / analytic tool for implementing the mini project.

First year ME students will each do a 14-week mini project, each generally comprising about one week of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment (see assessment information below), 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 should 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. All the projects should contain a clear statement of the research objectives, background of work, Literature review, techniques used, prospective deliverables, benefit from this [line of] research, Detailed discussion on results, Conclusions and references.

Assessment:

1. 50% of marks for a scientific report on the project.

Regarding the formatting and structure, the report should be written as a journal article using the style file of a journal appropriate for the field of the research (which journal format is most appropriate should be agreed between student and supervisor). Regarding content, the report should be understandable by your fellow students, so the introduction and literature review could be a bit more detailed than in a research paper. The results and discussions are in elaborate form and at end conclusions and include references.

2. 50% of marks for an oral presentation which will take place at the end of the semester and evaluation by a committee consist of Supervisor, one senior faculty and Head of the department or his nominee.

Outcomes:

Students are able to:

1. Formulate a specific problem after proper Literature Survey.
2. Develop model/models either theoretical/practical/numerical form.
3. Simulate / analyze/ conduct of experiment and obtaining the results.
4. Conclude and Correlate the results obtained.
5. Prepare and write the documentation in standard format.

16ECC112

PROJECT WORK - PROJECT SEMINAR

Instruction		End Exam- Duration	-
Sessionals	100 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of subjects related to the project work is required.

Course Objectives:

The overall objective of the project seminar is to help develop an emerging field at the intersection of multi-disciplinary understandings of engineering education

1. To prepare the students for the dissertation to be executed in 4th semester for the Post Graduate dissertation.
2. To explore new research from a range of academic disciplines which throws light on the questions unanswered.
3. To showcase a cutting edge research on engineering Problems.

The main objective of the Project Seminar is to prepare the students for the dissertation to be executed in 4th semester. Solving a real life problem should be focus of Post Graduate dissertation. Faculty members should prepare the project briefs (giving scope and reference) at the beginning of the 3rd semester, which should be made available to the students at the departmental library. The project may be classified as hardware / software / modeling / simulation. It may comprise any elements such as analysis, synthesis and design.

The department will appoint a project coordinator who will coordinate the following:

- Allotment of projects and project guides.
- Conduct project - seminars.

Each student must be directed to decide on the following aspects

- Title of the dissertation work.
- Organization.
- Internal / External guide.
- Collection of literature related to the dissertation work.

Each student must present a seminar based on the above aspects as per the following guidelines:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through OHP, PC followed by a 10 minutes discussion.
3. Submit a report on the seminar presented giving the list of references.

Project Seminars are to be scheduled from the 3rd week to the last week of the semester. The internal marks will be awarded based on preparation, presentation and participation.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Effectively incorporate and document appropriate sources in accordance with the formatting style, proper for the discipline and effectively utilize the conventions of standard written English.
3. Better understand the role that effective presentations have in public/professional contexts and gain experience in formal/informal presentation.
4. Identify and critically evaluate the quality of claims, explanation, support, and delivery in public and professional discourse, and understand the factors influencing a speaker's credibility.
5. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids. Deliver well-rehearsed and polished presentations meeting time requirements, content, and interactive requirements.

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16ECC113

PROJECT WORK AND DISSERTATION

Instruction	--	End Exam- Duration	--
Sessionals	100	End Exam- Marks	100

Prerequisites: A prior knowledge of subjects related to the project work is required.
Course Objectives:
The Objectives of the dissertation are to:
1. Put into practice theories and concepts learned on the programme and to provide an opportunity to study a particular topic in depth;
2. Show evidence of independent investigation;
3. Show evidence of ability to plan and manage a project within deadlines.

The students must be given clear guidelines to execute and complete the project on which they have delivered a seminar in the 3rd semester of the course.

All projects will be monitored at least twice in a semester through student's presentation. Sessional marks should be based on the grades/marks, awarded by a monitoring committee of faculty members as also marks given by the supervisor.

Efforts be made that some of the projects are carries out in industries with the help of industry coordinates.

Common norms will be established for documentation of the project report by the respective department.

The final project reports must be submitted two weeks before the last working day of the semester.

The project works must be evaluated by an external examiner and based on his comments a viva voice will be conducted by the departmental committee containing of HOD, two senior faculty and supervisor.

Course Outcomes:
On satisfying the requirements of this course, students will have the knowledge and skills to:
1. Plan, and engage in, an independent and sustained critical investigation and evaluation of a chosen research topic, relevant to environment and society
2. Systematically identify relevant theory and concepts, relate them to appropriate methodologies and evidence, apply appropriate techniques and draw appropriate conclusions
3. Engage in systematic discovery and critical review of appropriate and relevant information sources
4. Appropriately apply qualitative and/or quantitative evaluation processes to original data\ Define, design and deliver an academically rigorous piece of research.
5. Appreciate practical implications and constraints of the chosen topic.

16EC C201

MICROCONTROLLERS FOR EMBEDDED SYSTEMS DESIGN

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:
Upon completing this course, students will be able to:
1. Acquire an overview of Embedded architecture
2. Understand the architectures of different microcontrollers to design embedded applications
3. Program 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
Introduction to Embedded Systems: Review of Microprocessors and their features. Differences between Microprocessors and Microcontrollers, Application areas of Embedded Systems, Categories of Embedded Systems.Overview of Embedded System Architecture, Challenges & Trends of Embedded Systems, Hardware Architecture, Software Architecture.

UNIT-II
Architecture, Instruction Set, Addressing Modes, ALP, Timers and Counters, Serial Communication, Interrupt Programming of 8051. Interfacing with External Memory, Expansion of IO Ports.Introduction to embedded cross compilers.

UNIT-III
Interfacing 8051 with ADC, DAC, LCD and Stepper Motor.PIC 18 Family Overview, Architecture, Instruction Set, Addressing modes, Timers and Interrupts of PIC 18.

UNIT-IV
Capture/Compare and PWM modules of PIC 18.Introduction to RISC Concepts with ARM Processor.Embedded Software Development Tools, Host and Target Machines, Linkers/Locators for Embedded Software, Getting Embedded Software into the Target System.

UNIT-V
Debugging Techniques- Testing on your Host Machine, Instruction Set Simulators, Using Laboratory Tools.
Case Studies: Design of Embedded Systems using Microcontrollers – for applications in the area of communications and automotives. (GSM/GPRS, CAN ,Zigbee)

Suggested Readings:

1. David.E.Simon , “An Embedded Software Primer” Pearson Education.
2. Mazidi M.A and Mazidi J.G, “The 8051 Microcontroller and Embedded Systems” , Pearson 2007.
3. Mazidi, MCKinlay and Danny Causey, “PIC Microcontrollers and Embedded Systems”, Pearson Education.
4. Raj Kamal,Embedded Systems – Architecture, Programming and Design ,2nd Edition, TMH, 2008.

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16EC C202

CMOS VLSI Design

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:

Students will be able to

1. Understand various VLSI design abstraction levels and logic styles
2. Know various advanced CMOS logic design techniques
3. Learn logic families and building blocks of Digital design
4. Analyze memory and programmable logic devices
5. Design and implement various Digital CMOS systems

UNIT I

Introduction: Introduction to VLSI System design hierarchical design – design abstraction – different levels of abstraction and domains. MOS Transistor theory- NMOS inverter and logic gates-CMOS inverter and logic –Transmission gate logic design-Differential CMOS logic circuits.

UNIT II

Advanced CMOS Logic Design: Static CMOS Digital Latches- dynamic CMOS latches-CMOS Flip-flops- pseudo NMOS and dynamic pre-charging, domino- CMOS logic, no race logic, single-phase dynamic logic, dynamic differential logic.

UNIT III

Logic Families and Building Blocks for Digital Design:

Emitter coupled logic gates - current mode logic gates - BiCMOS Logic gates, Building blocks for digital design: multiplexer, demultiplexer, decoder, encoder -Barrel Shifter-Counters-Digital Adders-Multipliers-Parity generators-Detectors-Comparators.

UNIT IV

Memory and Programmable Logic: CMOS design methods: Structured design strategies – Hierarchy, regularity modularity, SRAM-Sense amplifier-address buffer and decoder, DRAM, ROM, Logic Arrays- PLA, PAL, Gate Arrays-FPGA, Design for testability.

UNIT V

System Case Studies: Finite State Machine (FSM), Algorithmic State Machines (ASMS), synchronization failure and meta stability, CMOS System case study: Core of RISC Micro Controller ALU address architectures.

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Suggesting Readings:

1. Ken Martin, "Digital Integrated Circuit Design", Oxford University Press 2000.
2. Weste Kamran Eshraghian, Principles of CMOS VLSI design – a Systems Perspective by NEILHE, Pearson Education Series, Asia 2002.
3. John P. Uyemura, "Introduction to VLSI Circuits and systems", John Wiley & Sons, 2011.
4. Sung-Mo Ang& Yusuf Leblebigi , "CMOS Digital Integrated Circuits Analysis and Design"- Mc-Gra-Hill Higher Education, 2nd Edition2003.

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16EC C205

ANALOG AND MIXED SIGNAL IC DESIGN

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:
Students will able to:

1. Define the characteristics MOSFET, Differential amplifier, Operational Amplifier and Data Converters
2. Understand the behavior of Current Mirror, MOS as an Analog Element.
3. Apply the concepts Current Mirror in analyzing Differential Amplifier, Operational Amplifier.
4. Analyze Different Amplifiers and Operational Amplifier with Different Loads.
5. Compare, Create, Design, Develop different types of data converters amplifiers with different loads.

UNIT I

Brief Review of Small Signal and Large Signal Model of BJTs and MOSFETs.
Current Mirrors and Single Stage Amplifiers – Simple CMOS current mirror, common source amplifier, source follower, common gate amplifier, cascode amplifiers. Source degenerated current mirrors. High out impedance – current mirrors, cascode gain stage Wilson current mirror, MOS differential pair and gain stage. Bipolar current mirrors – bipolar gain stages. Differential pairs with current mirror loads MOS and bipolar widlar current sources,

UNIT II

Operational amplifiers, Basic two stage MOS Operational amplifier–Characteristic parameters, two stage MOS Op-Amp with Cascodes. MOS Telescopic-cascode Op-Amp.MOS Folded cascode op-amp.MOS Active Cascode Op-Amp.Fully differential folded cascode op-amp.Current feedback op-amps.Stability and frequency compensation of op-amps. Phase margin and noise in op-amps.

UNIT – III

Comparators: Op-Amp Based Comparators, Charge Injection Errors – Latched Comparators – CMOS and BiCMOS Comparators – Bipolar Comparators.
Switched capacitor circuits: Basic building blocks; basic operation and analysis, inverting and non inverting integrators, signal flow diagrams, first order filter.
Sample and hold circuits - Performance requirements, MOS sample and hold basics, clock feed through problems,

UNIT – IV

S/H using transmission gates, high input impedance S/H circuits, improved S/H circuits from the point of slewing time, clock feed through cancellations. Data converter fundamentals - performance characteristics, ideal D/A and A/D converters, quantization noise. Nyquist rate D/A converters – decoder based converter, binary-scaled converters.Thermometer code converters, current mode converters.

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UNIT – V

Nyquist rate A/D Converters: Integrated converters – successive approximation converters, cyclic A/D converters, Flash or parallel converters, Two step A/D converters, pipelined A/D converters.

Over sampling converters. Over sampling without noise shaping over sampling and with noise shaping, system architecture – digital decimation filters.

supply insensitive biasing, temperature insensitive biasing, band gap reference, band gap reference circuits.

Suggested Readings:

1. Paul.R. Gray & Robert G. Major, Analysis and Design of Analog Integrated Circuits, John Wiley & sons. 2004
2. David Johns, Ken Martin, Analog Integrated Circuit Design, John Wiley & sons. 2004
3. BehzadRazavi, Design of Analog CMOS Integrated Circuits, Tata McGrah Hill. 2002
4. Jacob Baker.R.et.al., CMOS Circuit Design, IEEE Press, Prentice Hall, India, 2000.

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16EC E201

COMPUTER COMMUNICATION NETWORKS

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:
Upon completion of this course, the student will be able to

1. Explain the importance of data communications and each of the Computer Networks related communication protocols in a structured architecture.
2. Analyze the services and features at various layers of data communication network architecture such as switching methodologies, flow and error control mechanisms etc.
3. Select appropriate routing strategies and congestion control algorithms for various networks.
4. Distinguish the operation of UDP & TCP and IPV 4 and IPV6 in terms of features and concepts.
5. Analyze the features and operations of various technologies like ATM, ISDN and applications like Mail Transfer, network management etc.

UNIT – I
Data Communications Model, communication Tasks, basic concepts of Networking and Switching, Line/Networking configurations; Protocols, PDU, OSI and TCP/IP Architectures, Comparisons between OSI and TCP/IP;

UNIT – II
Flow Control, Sliding Window Flow Control, Error control, ARQ Protocols. Data Link Control, Bit stuffing, HDLC frame format, HDLC Modes and Operation; Circuit Switching concepts, Circuit SwitchElements, Three Stage Blocking type Space Division Switch;

UNIT – III
Packet Switching, Datagram and Virtual Circuit switching Principles, Effects of variable packet size. Control Signaling Functions, In Channel Signaling, Common Channel Signaling, Introduction to Signaling System Number 7 (SS7); Topologies, Choice of Topology, Ring and Star Usage, MAC and LLC, Generic MAC Frame Format; Hubs, Switches.Bridge, Bridge Operation, Bridges and LANs.

UNIT – IV
Routing, Routing strategies; Internetworking; Internet Protocol, IP address, IPv4, IPv6 comparison; Transport layer protocols, UDP Operation, TCP features, TCP/IP Addressing Concepts, Credit based Flow Control, Congestion Control.

UNIT – V
Wireless LAN, IEEE 802.11 Architecture, IEEE 802.11- Medium Access Control logic; ATM,

features of ATM, Quality of Service in ATM; Security in the Internet Network Management System, SNMP.

Suggested Readings:

1) William Stallings, “Data and Computer Communications”, Ninth Edition, Pearson Prentice Hall, 2011.
2) Behrouz A. Forouzan, “Data Communications and Networking”, Fourth Edition, Tata McGraw Hill, 2007.

16EC E206

VLSI TECHNOLOGY

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:
Upon completion of this course, students will be able to:

1. Study of various structures of Passive and Active Components
2. Understanding of various fabrication process steps of oxidation, lithography, etc. VLSI technology
3. To understand the process of VLSI circuit fabrication.
4. Analyze Clean rooms and their importance in VLSI technology
5. To understand Die, Bonding ,Packaging and testing.

UNIT I

Introduction – Integrated Circuits Review of history of VLSI technology progress–. Electronic Functions – Components – Analog and Digital ICs.Basic Devices in ICs – Structures Resistors – Capacitors – Inductors.Diodes – Bipolar Junction Transistors – Field Effect Transistors.Isolation techniques in MOS and bipolar technologies.

UNIT II

Monolithic ICs – 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. Process Flow for Realization of Devices.Description of Process Flow for Typical Devices viz., FET and BJT.

UNIT III

Silicon Wafer Preparation – Electronic Grade Silicon – CZ and FZ Methods of Single Crystal Growth – Silicon Shaping – Mechanical Operations, Chemical Operations – Prefabrication Processes.
Epitaxy: Growth Dynamics – Process Steps. Vapour phase, Solid phase and Molecular Beam Epitaxial Processes. Epitaxial Reactors.
Oxide Growth: Structure of SiO_2, Growth Mechanism and Dynamics – Oxide Growth by Thermal method.

UNIT IV

Deposition techniques Chemical Vapour Deposition (CVD) and associated methods like LPCVD and PECVD. PVD thermal evaporation and sputtering. Step coverage issues.
Lithography: Steps involved in Photolithography – Quality of the Pattern – photo resists and their characteristics, optical exposure systems contact and projection systems, steppers, X-ray – Electron Beam Lithography.
Etching: Chemical, Electro Chemical – Plasma (Dry Etching) Reactive Plasma Etching.

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UNIT V

Ion implantation: Range and Penetration Depth – Damage and Annealing – Ion Implantation machine.Diffusion: Constant and Infinite Source Diffusions – Diffusion Profiles – Diffusion Systems – Multiple Diffusions and Junction Formations. Packaging: die and Bonding and Packaging, Testing.Clean rooms and their importance in VLSI technology

Suggested Reading:

1. S.M. Sze,VLSI Technology, McGrawhill International Editions.
2. CY Chang and S.M. SZe , VLSI Technology, Tata McGraw-Hill Companies Inc.
3. J.D.Plummer, M.D.Deal and P.B.Griffin ,The Silicon VLSI Technology Fundamentals, Practice and modeling, Pearson Education 2009
4. Stephen A, The Science and Engineering of Microelectronic Fabrication , Campbell Oxford 2001

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16EC E213

OPTIMIZATION TECHNIQUES

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Objectives:

This course aims to:

1. Differentiate between LPP and NLP problems.
2. Differentiate between local variables and global variables.
3. Introduce the concepts of Genetic algorithm.

Course Outcomes:

Upon completion of the course, the student will be able to:

1. Formulate simple OT problems to maximise the profit.
2. Apply the LPP techniques to obtain optimal solution.
3. Apply the concepts of Sensitivity analysis to update the optimal solution from time to time.
4. Solve simple NLP problems using the gradient based methods.
5. Understand and apply the GA algorithm to get global optimal solution.

UNIT I

Use of optimization methods.Introduction to classical optimization techniques, motivation to the simplex method, simplex algorithm, sensitivity analysis.

UNIT II

Search methods - Unrestricted search, exhaustive search, Fibonocci method, Golden section method, Direct search method, Random search methods, Univariate method, simplex method, Pattern search method.

UNIT III

Descent methods, Gradient of function, steepest decent method, conjugate gradient method. Characteristics of constrained problem, Direct methods, The complex method, cutting plane method.

UNIT IV

Review of a global optimization techniques such as Monte Carlo method, Simulated annealing and Tunneling algorithm.

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UNIT V

Generic algorithm - Selection process, Crossover, Mutation, Schema theorem, comparison between binary and floating point implementation.

Suggested Readings:

1. SS Rao, "Optimization techniques", PHI, 1989.
2. Zhigmiew Michelewicz, "Genetic algorithms + data structures = Evaluation programs", Springer Verlog - 1992.
3. Merrium C. W., "Optimization theory and the design of feedback control systems", McGraw Hill, 1964.
4. Weldo D.J., "Optimum seeking method", PHI, 1964.

16EC C207

LAB-1 DESIGN AND SIMULATION LABORATORY-I

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Course Outcomes:

Students will able to:

1. Define the characteristics tool and design entry in the tool
2. Understand the design spics and library files of tool
3. Apply the concept of theory in the lab implementation and Analyze power and delay calculation from the graphs
4. Understand the usage of various debugging tools available to program microcontrollers
5. Analyze the hardware and software interaction and integration and Design & develop the 8051 based embedded systems for various applications

Note: all the experiments are to be carried out independently by each student with different specifications. At least 12 experiments are to be carried out.

(i) Design and simulation of combinational circuits

(ii) Design and simulation of sequential circuits

(iii) Design and simulation of mixed signal circuits

(iv) Microcontroller programming

a. Toggling the LEDs,

b. serial data transmission,

c. LCD and Key pad interface

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16EC C209

SEMINAR – 1

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of any Subject in Embedded System and VLSI Design (related to the seminar topic) is required.

Course Objectives:

1. Awareness of how to use values in improving own professionalism
2. Learning about personal and communication styles
3. Learning management of values for personal and business development
4. Increase knowledge of Emotional Intelligence

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Demonstrate effective writing skills and processes by employing the rhetorical techniques of academic writing, including invention, research, critical analysis and evaluation, and revision.
3. Effectively incorporate and document appropriate sources in accordance with the formatting style proper for the discipline and effectively utilize the conventions of standard written English.
4. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids.
5. Deliver well-rehearsed and polished presentations meeting time, content, and interactive requirements.

Oral presentation and technical report writing are two important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in the advanced fields of Embedded System and VLSI Design and related topics.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects for a seminar presentation.

- Literature survey
- Organization of the material
- Presentation of OHP slides / LCD presentation
- Technical writing

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Each student required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes time for presentation following by a 10 minutes discussion.
3. Submit a detailed technical report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule shall not be entertained.

For award of sessional marks, students are to be judged by at least two faculty members on the basis of an oral and technical report preparation as well as their involvement in the discussions.

SOFT SKILLS

16 EG 104

Instruction	2 Hours per week	End Exam- Duration	-
Sessionals	Satisfactory/Unsatisfactory	End Exam- Marks	-

Prerequisite for the Course: - The students should be graduates with basic English proficiency and possess knowledge of both verbal and non-verbal communication skills.

Course Objectives:
To help the students

1. Participate in group discussions and case studies with confidence and to make effective presentations. To equip them with resume packaging, preparing and facing interviews.
2. Build an impressive personality through effective time management, leadership, self-confidence and assertiveness.
3. Understand what constitutes proper grooming and etiquette in a professional environment. To be competent in verbal aptitude.

Exercise 1
Group Discussion & Case studies – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
Elements of effective presentation – Structure of presentation – Presentation tools – Body language
Creating an effective PPT

Exercise 2
Interview Skills – Resume’ writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets
Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

Exercise 3
Personality Development – Effective Time Management, assertiveness, decision making and problem solving, stress management, team building and leadership.

Exercise 4
Corporate Culture – Grooming and etiquette, corporate communication etiquette.
Academic ethics and integrity

Exercise 5
Verbal Aptitude – Sentence correction, sentence completion, jumbled sentences and vocabulary. Reading comprehension.

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16EC C203

RF IC DESIGN

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:

Students will able to:

1. Define the characteristics RF systems, Tuned circuits, LNA, Mixers
2. Understand the behavior of RF systems, Reflection Coefficient and Noise in the MOS device
3. Apply the concepts noise and to characterize the amplifiers (Unit I,V)
4. Analyze different Power Amplifiers at RF range (all units)
5. Compare Design, Develop and Improve the performance of LNA, Power amplifier, PLL

Unit I:

RF systems – basic architectures, Transmission media and reflections, Maximum power transfer, Passive RLC Networks, Parallel RLC tank, Q ,Series RLC networks, matching, Pi match, T match , Passive IC, Interconnects and skin effect, Resistors, capacitors, Inductors.

Unit II:

Review of MOS Device Physics, MOS device review , Distributed Systems ,Transmission lines, reflection coefficient, The wave equation, examples, Lossy transmission lines ,Smith charts – plotting gamma, High Frequency Amplifier Design, Bandwidth estimation using open-circuit time constants , Bandwidth estimation using short-circuit time constants.

Unit III:

Risetime, delay and bandwidth, Zeros to enhance bandwidth, Shunt-series amplifiers, tuned amplifiers Cascaded amplifiers Noise Thermal noise, flicker noise review, Noise figure, LNA Design .

Unit IV:

Intrinsic MOS noise parameters ,Power match versus noise match, Large signal performance, design examples & Multiplier based mixers, Mixer Design, Subsampling mixers, RF Power Amplifiers, Class A,AB,B, C amplifiers, Class D,E, F amplifiers, RF Power amplifier design examples.

Unit V:

Voltage controlled oscillators, Resonators , Negative resistance oscillators , Phase locked loops Linearized PLL models , Phase detectors, charge pumps, Loop filters, PLL design examples, Frequency synthesis and oscillator Frequency division, integer-N synthesis , Fractional frequency synthesis, Phase noise, General considerations , Circuit examples, Radio Architectures, GSM radio architectures, CDMA, UMTS radio architectures.

Suggested Readings:

1. The Design of CMOS Radio-Frequency Integrated Circuits by Thomas H. Lee. Cambridge University Press, 2004.
2. RF Microelectronics by BehzadRazavi.Prentice Hall, 1997.

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16EC C204

EMBEDDED PROCESSORS AND ARCHITECTURE

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:

Students will be able to:

1. Understand the basic architectural needs of Programmable DSPs
2. Understand the advanced VLIW architecture of TMS320C54XX of Programmable DSPs
3. Compare and select ARM processor core based on requirements of embedded Application
4. Use different software development tools like Code Composer Studio to develop any DSP based embedded application
5. Design and Develop small applications on DSP processor based platform

UNIT I

Introduction to DSP Processors: Differences between DSP and other μp architectures, their comparison and need for special ASP^s , RISC & CISC CPUs. Number formats- Fixed point and Floating point formats, Dynamic range and precision.

UNIT II

Data Paths, Basic architectural features, DSP computational building blocks, Bus and Memory architecture, Address generation unit, speed issues, Synchronous serial interface, Multichannel Buffered serial port(McBSP).

UNIT III

Overview of DSP processor design: fixed point DSP^s – Architecture of TMS 320C 54X Processor , addressing modes, Assembly instructions, Pipelining and on-chip peripherals.

UNIT IV

DSP interfacing & software development tools: Interfacing memory and parallel I/O peripherals, DSP tools – Assembler, debugger, c-compiler, linker, editor, code composer studio.

UNIT V

ARM Processor families, Architecture-revisions, Registers, pipeline, exception, interrupts and the vector table; core extensions, introduction to ARM instruction set

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Suggested Readings:

1. Avatar Singh and S. Srinivasan, " Digital Signal Processing Implementations Using DSP Microprocessors", Thomson Brooks, 2004.
2. Phil Lapsley, Jeff Bier, AmithShoham and Edward A Lee, "DSP Processor Fundamentals", S. Chand & Company Ltd, 2000.
3. B. Ventakaramani, M. Bhaskar, "Digital Signal Processes, Architecture Processing and Applications", Tata McGraw Hill, 2002.
4. Andrew N.SLOSS, DomonicSymes, Chris Wright "ARM System Developers Guide-Desisning and optimizing system software" ELSEVIER 1st Edition 2004.

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16EC C206

REAL TIME OPERATING SYSTEMS

Instruction	4 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Objectives:

1. To understand the basic concepts of the UNIX operating system and POSIX Standards.
2. To know the importance of hard/soft Real-Time systems and to familiarize the use cases for tasks, semaphores, queues, pipes, and event flags.
3. To study the basics of the kernel objects and memory management in VxWorks and to know about real-time applications development tools.

Course Outcomes:

At the end of the semester, student will be able to:

1. Understand the Unix operating system and shell programming.
2. Know the standards of POSIX and its portability.
3. Illustrate the problems on scheduling in hard and soft real time systems.
4. Understand the in-depth knowledge on Real Time Operating System concepts and real time concepts using VxWorks .
5. Know about the 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, Soft Real-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 Priorities, Scheduling, Intertask Communication & Synchronization – Definition of Context Switching, Foreground ISRs and Background Tasks. Critical Section – Reentrant Functions, Interprocess Communication (IPC) – IPC through Semaphores, Mutex, Mailboxes, Message Queues or Pipes and Event Flags.

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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.

UNIT V

Debugging Tools and Cross Development Environment – Software Logic Analyzers, ICEs. Comparison of RTOS – VxWorks, µC/OS-II and RT Linux for Embedded Applications.

Suggested Readings:

1. Jane W.S.Liu, Real Time Systems, Pearson Education, Asia, 2001.
2. Betcnhof, D.R., Programming with POSIX threads, Addison - Wesley Longman, 1997.
3. Wind River Systems, VxWorks Programmers Guide, Wind River Systems Inc.1997.
4. Jean.J.Labrosse, MicroC/OS-II, The CMP Books.
5. Real Time Systems, C.M.Krishna and G.Shin, McGraw-Hill Companies Inc., McGraw Hill International Editions, 1997.

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16EC E210

VLSI PHYSICAL DESIGN AUTOMATION

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:

Upon completion of this course, students will be able to:

1. Study automation process for VLSI system design.
2. Fundamentals of VLSI Layout and design rules.
3. Demonstrate knowledge of combinational optimization techniques.
4. Understanding of fundamentals for various physical design CAD tools.
5. Develop and enhance the existing algorithms and computational techniques for physical design process of VLSI systems.

UNIT I

Scope of physical design – Components of VLSI – Various layers of VLSI – Typical structures of BJTS, MOSFETS, Resistors, capacitors, inductors, interconnects, brief review of technology, cost and performance analysis.

UNIT II

Basic concepts of Physical Design - layout of basic structures – wells, FET, BJT, resistors, capacitors, contacts, vias and wires (Interconnects). Mask overlays for different structures. Parasitics – latch up and its prevention. Device matching and common centroid techniques for analog circuits

UNIT III

Design rules – fabrication errors, alignment sequence and alignment inaccuracies, process variations and process deltas, drawn and actual dimensions and their effect on design rules– scalable design rules. Scalable CMOS (SCMOS) design rules, layout design, and stick diagrams, Hierarchical stick diagrams.

UNIT IV

Cell concepts – cell based layout design – Wein-berger image array – physical design of logic gates – NOT, NAND and NOR – design hierarchies. System level physical design, large scale physical design, interconnect delay modeling, floor planning, routing and clock distribution.

UNIT V

CAD Tools: Layout editors, Design rule checkers, circuit extractors – Hierarchical circuit extractors – Automatic layout tools, silicon compilers, modeling and extraction of circuit parameters from physical layout.

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Suggested Readings:

1. Preas, M. Lorenzatti, “Physical Design and Automation of VLSI Systems”, The Benjamin – Cummins Publishers, 1998.
2. M. Shoji, “CMOS Digital Circuit Technology”, Prentice Hall, 1987.
3. John P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley & sons, Inc.
4. Modern VLSI Design (System on Chip), Woyne Wolf, Pearson Education, 2002.
5. R. Jacob Baker; Harry W.Li., David E. Boyce, CMOS Circuit Design, Layout and Simulation, IEEE Press, Prentice Hall of India.

16EC E207

LOW POWER VLSI DESIGN

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand concepts of power and energy and design strategies for low power
2. Acquire knowledge of power estimation techniques at different abstractions of digital design
3. Analyse various power optimization techniques
4. Analyse energy recovery circuit designs
5. Understand the concepts of Software Design for Low Power

UNIT-I

Introduction and need of low power design, sources of power dissipation, MOS transistor leakage components, SOI technology, FinFET, Back gate FET, power and energy basics, power dissipation in CMOS circuits, Energy-delay product as a metric, design strategies for low power.

UNIT-II

Power Estimation Techniques: Circuit Level – Modeling of Signals, Signal Probability Calculations, Statistical techniques; High Level Power Analysis – RTL Power Estimation, Fast Synthesis, Analytical Approaches, Architectural Power Estimation.

UNIT-III

Power Optimization Techniques – I: Dynamic Power Reduction – Dynamic Power Component, Circuit Parallelization, Voltage Scaling Based Circuit Techniques, Circuit Technology – Independent Power Reduction, Circuit Technology Dependent Power Reduction; Leakage Power Reduction – Leakage Components, Design Time Reduction Techniques, Run-time Stand-by Reduction Techniques, Run-time Active Reduction Techniques Reduction in Cache Memories.

UNIT-IV

Power Optimization Techniques – II: Low Power Very Fast Dynamic Logic Circuits, Low Power Arithmetic Operators, Energy Recovery Circuit Design, Adiabatic – Charging Principle and its implementation issues.

UNIT-V

Software Design for Low Power: Sources of Software Power Dissipation, Software Power Estimation, Software Power Optimizations, Automated Low-Power Code Generation, Co-design for Low Power.

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Suggested Readings:

1. Kaushik Roy and Sharat Prasad, Low-Power CMOS VLSI Circuit Design, Wiley Inter-science Publications, 2000.
2. Christian Piguet, Low Power CMOS Circuits Technology, Logic Design and CAD Tools, 1^{st} Indian Reprint, CRC Press, 2010.
3. J. Rabaey,Low Power Design Essentials, 1^{st} Edition, Springer Publications, 2010.

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16EC E204

CPLD & FPGA Architectures and Applications

Instruction	3 Hours per week	End Exam- Duration	3 Hours
Sessionals	30 Marks	End Exam- Marks	70 Marks

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: Programmable read only memory (prom), programmable logic array (pla), programmable array logic (pal). Sequential programmable logic devices (splds). Programmable gate arrays (pgas), CPLD and FPGA, design flow using FPGA, programming technologies.

UNIT II

FPGAs: Field Programmable Gate Arrays – Logic blocks, routing architecture, Logic cells and features of commercially available FPGA's- XILINX XC4000, virtexII FPGA's, XILINX SPARTAN II, Alteras Act1, Act2, Act3 FPGA's, Actel FPGA's, AMD FPGA.

UNIT III

CPLD's: complex programmable logic devices, logic block, I/O block, interconnect matrix, logic blocks and features of altera flex logic 10000 series CPLD's , max 7000 series CPLD's, AT & T – ORCA's (Optimized Reconfigurable Cell Array), cypres flash 370 device technology, lattice plsi's architectures.

UNIT IV

Placement: objectives, placement algorithms: Mincut-Based placement, iterative improvement placement,simulated annealing.

Routing: objectives, segmented channel routing, Maze routing, Routability estimation, Net delays, computing signal delay in RC tree networks.

UNIT V

Digital Front End and back End tools for FPGAs & ASICs, FPGA implementation steps.

Verification: introduction, logic simulation, design validation, timing verification.

Testing concepts: failures, mechanisms and faults, fault coverage, ATPG methods, programmability failures.

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Suggested Reading:

1. P.K. Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Pearson Education 2009.
2. S. Trimberger, Edr., Field Programmable Gate Array Technology, Kluwer Academic Publications, 1994.
3. J. Old Field, R. Dorf, Field Programmable Gate Arrays, John Wiley & Sons, Newyork, 1995.
4. S. Brown, R. Francis, J. Rose, Z.Vransic, Field Programmable Gate array, Kluwer Publn, 1992.
5. Manuals from Xilinx, Altera, AMD, Actel.

16EC C208

LAB 2 DESIGN AND SIMULATION LABORATORY-II

(Synthesis, Backend and Embedded Systems Laboratory)

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Course outcomes:

Students are able to:

1. Design, simulate and synthesis combinational circuits
2. Design, simulate and synthesis sequential circuits
3. Design, simulate and draw layouts for CMOS designs
4. Develop the scheduling algorithms programming, on Real Time Operating systems.
5. Develop the programs on message queues, semaphores and mailbox for real time data.

Note: all the experiments are to be carried out independently by each student with different specifications. Atleast 12 experiments are to be carried out.

(i) Synthesis of combinational circuits (4 to 6 MSI digital blocks).

(ii) Synthesis of sequential circuits (4 to 6 MSI digital blocks).

(iii) Schematic simulation, layout, DRC, LVS, parasitic extraction for cells (inverter, NAND gate, NOR gates).

(iv) Programming using real time operating systems

   a. Multi tasking using round robin scheduling
   b. IPC using message queues
   c. IPC using semaphore
   d. IPC using mail box

16EC C210

SEMINAR - 2

Instruction	3 Hours per week	End Exam- Duration	-
Sessionals	50 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of any Subject in Embedded System and VLSI Design (related to the seminar topic) is required.

Course Objectives:

1. Awareness of how to use values in improving own professionalism
2. Learning about personal and communication styles
3. Learning management of values for personal and business development
4. Increase knowledge of Emotional Intelligence

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Demonstrate effective writing skills and processes by employing the rhetorical techniques of academic writing, including invention, research, critical analysis and evaluation, and revision.
3. Effectively incorporate and document appropriate sources in accordance with the formatting style proper for the discipline and effectively utilize the conventions of standard written English.
4. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids.
5. Deliver well-rehearsed and polished presentations meeting time, content, and interactive requirements.

Oral presentation and technical report writing are two important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in the advanced fields of Embedded System and VLSI Design and related topics.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects for a seminar presentation.

- Literature survey
- Organization of the material
- Presentation of OHP slides / LCD presentation
- Technical writing

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Each student required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes time for presentation following by a 10 minutes discussion.
3. Submit a detailed technical report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule shall not be entertained.

For award of sessional marks, students are to be judged by at least two faculty members on the basis of an oral and technical report preparation as well as their involvement in the discussions.

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16EC C211

MINI PROJECT

Instruction		End Exam- Duration	-
Sessionals	--	End Exam- Marks	-

Prerequisite for the Course: - The Student s should have a prior knowledge of the core courses under curriculum.

Course Objectives:

Students are expected to:

1. Practice and experience the literature survey on the chosen field / topic.
2. Able to formulate the scope of the mini project.
3. Use simulation / analytic tool for implementing the mini project.

First year ME students will each do a 14-week mini project, each generally comprising about one week of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment (see assessment information below), 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 should 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. All the projects should contain a clear statement of the research objectives, background of work, Literature review, techniques used, prospective deliverables, benefit from this [line of] research, Detailed discussion on results, Conclusions and references.

Assessment:

1. 50% of marks for a scientific report on the project.

Regarding the formatting and structure, the report should be written as a journal article using the style file of a journal appropriate for the field of the research (which journal format is most appropriate should be agreed between student and supervisor). Regarding content, the report should be understandable by your fellow students, so the introduction and literature review could be a bit more detailed than in a research paper. The results and discussions are in elaborate form and at end conclusions and include references.

2. 50% of marks for an oral presentation which will take place at the end of the semester and evaluation by a committee consist of Supervisor, one senior faculty and Head of the department or his nominee.

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Outcomes:

Students are able to:

1. Formulate a specific problem after proper Literature Survey.
2. Develop model/models either theoretical/practical/numerical form.
3. Simulate / analyze/ conduct of experiment and obtaining the results.
4. Conclude and Correlate the results obtained.
5. Prepare and write the documentation in standard format.

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16EC C213

PROJECT WORK -PROJECT SEMINAR

Instruction	--------	End Exam- Duration	-
Sessionals	100 Marks	End Exam- Marks	-

Prerequisites: A prior knowledge of subjects related to the project work is required.

Course Objectives:

The overall objective of the project seminar is to help develop an emerging field at the intersection of multi-disciplinary understandings of engineering education

1. To prepare the students for the dissertation to be executed in IV semester, solving a real life problem should be focus of Post Graduate dissertation
2. To explore new research from a range of academic disciplines which throws light on the questions unanswered.
3. To showcase cutting edge research on engineering from outstanding academic researchers.

Course Outcomes:

Upon completion of this course, the student will be able to

1. Develop and support a relevant and informed thesis, or point of view, that is appropriate for its audience, purpose, discipline, and theme.
2. Effectively incorporate and document appropriate sources in accordance with the formatting style, proper for the discipline and effectively utilize the conventions of standard written English.
3. Better understand the role that effective presentations have in public/professional contexts and gain experience in formal/informal presentation.
4. Identify and critically evaluate the quality of claims, explanation, support, and delivery in public and professional discourse, and understand the factors influencing a speaker's credibility.
5. Develop audience-centered presentations meeting concrete professional objectives and integrating ethical and legal visual aids. Deliver well-rehearsed and polished presentations meeting time requirements, content, and interactive requirements.

The main objective of the Project Seminar is to prepare the students for the dissertation to be executed in IV semester. Solving a real life problem should be focus of Post Graduate dissertation. Faculty members should prepare the project briefs (giving scope and reference) at the beginning of the III semester, which should be made available to the students at the departmental library. The project may be classified as hardware / software / modeling / simulation. It may comprise any elements such as analysis, synthesis and design.

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The department will appoint a project coordinator who will coordinate the following:

- Allotment of projects and project guides.
- Conduct project - seminars.

Each student must be directed to decide on the following aspects

- Title of the dissertation work.
- Organization.
- Internal / External guide.
- Collection of literature related to the dissertation work.

Each student must present a seminar based on the above aspects as per the following guidelines:

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through OHP, PC followed by a 10 minutes discussion.
3. Submit a report on the seminar presented giving the list of references.

Project Seminars are to be scheduled from the 3rd week to the last week of the semester. The internal marks will be awarded based on preparation, presentation and participation.

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16EC C214

PROJECT WORK AND DISSERTATION

Instruction	--	End Exam- Duration	--
Sessionals	100	End Exam- Marks	100

Prerequisites: A prior knowledge of subjects related to the project work is required.

Course Objectives:

The Objectives of the dissertation are to:

1. Put into practice theories and concepts learned on the programme
2. Provide an opportunity to study a particular topic in depth;
3. Show evidence of independent investigation;
4. Combine relevant theories and suggest alternatives;
5. Enable interaction with practitioners (where appropriate to the chosen topic);
6. Show evidence of ability to plan and manage a project within deadlines

Course Outcomes:

On satisfying the requirements of this course, students will have the knowledge and skills to:

1. Plan, and engage in, an independent and sustained critical investigation and evaluation of a chosen research topic, relevant to environment and society
2. Systematically identify relevant theory and concepts, relate them to appropriate methodologies and evidence, apply appropriate techniques and draw appropriate conclusions
3. Engage in systematic discovery and critical review of appropriate and relevant information sources
4. Appropriately apply qualitative and/or quantitative evaluation processes to original data\ Define, design and deliver an academically rigorous piece of research.
5. Appreciate practical implications and constraints of the chosen topic.

The students must be given clear guidelines to execute and complete the project on which they have delivered a seminar in the III semester of the course.

All projects will be monitored at least twice in a semester through student's presentation. Sessional marks should be based on the grades/marks, awarded by a monitoring committee of faculty members as also marks given by the supervisor.

Efforts be made that some of the projects are carries out in industries with the help of industry coordinates.

Common norms will be established for documentation of the project report by the respective department.

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The final project reports must be submitted two weeks before the last working day of the semester.

The project works must be evaluated by an external examiner and based on his comments a viva voice will be conducted by the departmental committee containing of HOD, two senior faculty and supervisor.

16 EG C103

SOFT SKILLS LAB

Instruction	2 Periods 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 the course are to:

1. Participate in group discussions and case studies with confidence and to make effective presentations. Also to learn the art of communication.
2. With- resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management and goal setting, self confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.
5. To understand the elements of research and hone their soft skills through a live, mini project.

Course Outcomes: After 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 mange 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

Group Discussion & Case studies –dynamics of group discussion, intervention, summarizing,modulation of voice, body language, relevance, fluency and coherence.

Elements of effective presentation – Structure of presentation – Presentation tools – Bodylanguage

Creating an effective PPT

Exercise 2

Interview Skills –Resume writing–structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets

Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

Exercise 3

Personality Development–Effective Time Management, setting realistic goals, self confidenceand assertiveness, stress management, moral values.

Exercise 4

Corporate Culture –Grooming and etiquette, communication media etiquetteAcademic ethics and integrity

Exercise 5

Mini Project –General/Technical. Research, developing a questionnaire, data collection,analysis, written report and project seminar

Suggested Readings:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007
2. Leena Sen , "Communication Skills", Prentice-Hall of India, 2005
3. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006
4. Edgar Thorpe and Showick Thorpe , "Objective English", 2nd edition, Pearson Education, 2007
5. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010
6. Gulati and Sarvesh, " Corporate Soft Skills", New Delhi: Rupa and Co. , 2006
7. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004.
8. Covey and Stephen R, "The 7 Habits of Highly Effective People", New York: Free Press, 2016.

SCHOOL OF MANAGEMENT STUDIES
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16MB C108

INFORMATION TECHNOLOGY APPLICATIONS FOR BUSINESS

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

Course Objectives: The objectives of this course are:

1. To provide an insight of basic features of computers.
2. Enable students to acquire knowledge on information systems and its various categories.
3. To focus on planning and development of information systems.
4. To understand the difference between hardware and software systems.
5. To discuss the underlying principles of computer security.
6. To analyze the different concepts of information systems applications.

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

1. Understand the features of information systems.
2. Demonstrate detailed knowledge of the role of information system and its categories.
3. Gain knowledge on information system development.
4. Distinguish between the hardware and software systems.
5. Analyze various computer security mechanisms.
6. Understand applications of information technology for business.

Unit – I

Information Systems for Business

Need for Information Systems – Business in the Information age, Information systems Concepts, Computer Based Information Systems – Categories of Information Systems- Operational Support Systems- Management Support Systems- Strategic Information Systems. Functional Information Systems – IS support to Business Functions – Accounting and Finance, Marketing and Sales, Production and Logistics, and Human Resources Management Systems.

Unit – II

Information Systems Planning and Development

Systems Planning - Traditional System Development Life Cycle (SDLC) - alternate methods for System development - System development outside the system.

Software: System and Application Software, Compilers, Interpreters and Assemblers. Computer Languages: Levels of languages, generation and their features. Number System: Introduction to number system, binary, decimal and their inter conversions and their uses in computer.

Unit – III

Information Technology Infrastructure

Computer Hardware- I/O Devices, Memory Devices, Processor, Multimedia – Definition, Characteristics, Elements of Multimedia, Multimedia Applications. Data Communication and Computer Network – Definition, Types – Network Topologies-Network Devices, Wireless Networking. The Internet, Intranet.

Unit – IV

Computer Security

Need For Security - Security Threat and Attack- Malicious Software, Hacking, Security Services-Security Mechanisms - Cryptography, Digital Signature, Firewall- Types of Firewall-Identification and Authentication – Biometric Techniques – Other Security Measures - Security Policy.

Unit – V

Information Systems Application

Inter organizational- Global Information systems, Electronic Data Interchange (EDI), Electronic Funds Transfer (EFT) –Extranets, E-Commerce Overview- E-commerce Applications, M-Commerce Services and Applications, SMN, M-Analysis E-Governance- Emerging Trends in Computing – Cloud Computing, Grid Computing (Concepts only).

Text Books:

1. Turban, Rainer and Potter, "Introduction to Information Technology", John & Wiley Sons, 2002.
2. Anita Goel, "Computer Fundamentals", Pearson, 2013.
3. Ralph M. Stair&George W. Reynolds, "Principles of Information Systems", Thomson Course Technology", 2016.

Suggested Readings:

1. Ramesh Behl, "Information Technology for Management", McGraw-Hill Companies, 2009.
2. Ken Laudon, Jane Laudon & Rajnish Dass, "Management Information System", 11nd Ed. Pearson, 2010.
3. B. Muthukumaran, "Information Technology for Management", Oxford, 2010.

16MB C110

ORGANISATION BEHAVIOUR

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

Course Objectives: The objectives of the course are to:

1. Define basic organizational behavior principles and analyse how these influence behavior in the workplace.
2. Analyse the influence of perceptions and personality on individual human behavior in the workplace.
3. Discuss the theories of Motivation and Leadership.
4. Provide knowledge on different organizational structures; and concepts of culture, climate and organizational development.
5. Describe the interpersonal and their intrapersonal reactions within the context of the group and also demonstrate effective communication and decision making skills in small group settings.
6. Familiarize the students with the basic understanding of individual behavior and explore issues of power, politics, conflict and negotiation.

Course Outcomes: After completion of this course, students will be able to:

1. Enable the students to practically implement the Organizational Behavior principles and practice in real time situations.
2. Analyze the behavior, perception and personality of individuals and groups in organizations in terms of the key factors that influence organizational behavior.
3. Acquire knowledge in applying motivational theories to resolve problems of employees and identify various leadership styles and the role of leaders in decision making process.
4. To examine various organizational designs and explain concepts of organizational culture, climate and organizational development.
5. To explain group dynamics and skills required for working in groups and identify the processes used in developing communication and resolving conflicts.
6. Analyze organizational behavioral issues in the context of power, politics, conflict and negotiation issues.

Unit – I

Introduction

Organizational behavior – Nature and levels of organizational behavior – Individuals in organization – Individual differences – Personality and Ability – The Big 5 Model of personality – Organizationally relevant personality traits. The nature of perception – characteristics of the perceiver, target and situation – perceptual problems.

Unit – II

Organization Structure

Organizational Designs and Structures – Traditional and Contemporary organizational designs. Organizational culture and ethical behavior – factors shaping organizational culture– creating an ethical culture. Concepts - Organizational Climate, Organization Conflict, and Organization Development.

Unit – III

Motivation and Leadership

Motivation–early and contemporary theories of motivation. Leadership – early and contemporary approaches to leadership.

Unit – IV

Group Dynamics

Groups and group development – turning groups into effective teams. Managing change – process, types and challenges. Communicating effectively in organizations – communication process–barriers to communication–overcoming barriers to communication–persuasive communication–communication in crisis situations.

Unit – V

Power, Politics, Conflict and Negotiations

Power, Politics, Conflict and Negotiations–Sources of individual, functional and divisional Power. Organizational politics. Conflict – causes and consequences – Pondy's model of organizational conflict–conflict resolution strategies.

Text Books:

1. Jennifer George and Gareth Jones "Understanding and Managing Organizational Behavior", Pearson Education Inc., 2012.
2. Jon L Pierce and Donald G. Gardner, "Management and Organizational behavior", Cengage Learning India (P) Limited, 2001.
3. Richard Pettinger, "Organizational Behaviour", Routledge, 2010.

Suggested Readings:

1. Stephen P. Robbins, Jennifer George and Gareth Jones, "Management and Organizational Behaviour", Pearson Education Inc., 2009.
2. K. Aswathappa, "Organizational behavior", Himalaya Publishing House, 2013.
3. John Schermerhorn, Jr., James G. Hunt and Richard N. Osborn, "Organizational Behaviour",10t edition, Wiley India Edition, 2009.

16MB C111

BUSINESS ENVIRONMENT AND ETHICS

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

Course Objectives: The Objectives of the course are:

1. To familiarize the students with various aspects of economic, social, political and cultural environment of India.
2. To enable the students to understand the various industrial policies developed in the post-independence period and need for the same.
3. To provide an insight into the mechanism of fiscal policy implementation, structure of union budget, link between monetary policy and banking.
4. To provide an understanding about the changes in the growth of National Income, concept of Inflation in India.
5. To acquaint students with essence of WTO agreements and its implications, understand EXIM policies and changes in FEMA, and about the FDI and MNCs in emerging countries.
6. To make students to understand the ethical dilemmas facing managers; and the concept of corporate governance.

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

1. Gain a deeper understanding of the environmental factors influencing Indian business organizations.
2. Understand the issues related to the industrial policy and regulation and their amendments from time to time.
3. Understand the Union Budget, fiscal policy, monetary policy and banking.
4. To understand the changes in the growth of National Income, concept of Poverty, Unemployment and inflation and its causes and measures to control Inflation in India.
5. Take decisions to ensure growth and sustainability of the organizations through the knowledge gained by the students on capital markets, RBI guidelines; trade, EXIM policy and Foreign Exchange Management Act.
6. Develop thinking and analytical skills using ethical framework.

Unit-I

Introduction

Business Environment – Meaning, Importance, Environmental Factors; Planning in India – Planning Commision – Liberalisation and Planning; Industrial Policy and Regulatory Structure- Industrial Policy- Industrial

Licensing Policy- Five Year Planning- Industrial Policy 1991; Small Scale Industries (SSI)- Industrial Finance- Foreign Direct Investment (FDI).

Unit-II

Indian Financial System

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-III

Economic Growth

National Income, Foreign Trade and Balance of Payment, Poverty in India, Unemployment in India, Inflation, Human Development, Rural Development, Problems of Growth.

Unit-IV

India's Trade Policy

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 –Multi-national companies and FDI.

Unit-V

Business Ethics

An Overview, concepts and theories of Business ethics, Ethical Dilemmas, Sources and their Resolutions, Ethical Decision-making in Business, Globalization and Business Ethics, creating an Ethical Organization, Corporate ethics: Good Governance.

Text Books:

1. Justin Paul " Business Environment: Text & Cases" ,3/eTMH, 2012.
2. Gaurav Datt and Ashwani Mahajan, "Indian Economy", 72 ed, S.Chand, 2016.
3. A.C.Fernando, "Business Ethics", 1st Edition, Pearson, 2011.

Suggested Readings:

1. Francis Cherunilam "Business Environment: Text & Cases", HPH, 2012.
2. V.K.Puri and S.K.Misra, "Indian Economy", HPH, 2014.

16MB C101

PRINCIPLES OF MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To familiarize the students to the basic concepts of management in order to aid in understanding how an organization functions.
2. Enable the students to analyze and understand environment of the organization and significance of Decision-Making process.
3. To educate students on different structures in an organisation and delegation of authority.
4. To describe staffing and direction as a management function.
5. To discuss significance of Co-ordination in organizations.
6. To discuss and apply the control processes.

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

1. Practice the process of management functions and understand how management evolution affects future managers.
2. Explain why planning is needed in organizations, why objectives are necessary for successful planning and identify essential characteristics of decision-making.
3. Explain how organizations adapt to an uncertain environment and identify techniques managers use to influence and control the internal environment.
4. Differentiate between the various types of organizational structures and patterns, and explain the importance of delegation in organizations.
5. Analyze the requirement of human resource and effective direction.
6. Recognize the link between planning and controlling and understand how to control by comparing performance with objectives.

Unit-I

Introduction to Management

Concept of Management, Nature and Functions of Management, Difference between Management and Administration, Evolution of Management Thought: Scientific Management-Frederick W.Taylor - Henry Fayol's Principles - Human Relations Approach -Elton Mayo's Hawthorne experiments - Douglas McGregor's Theory 'X' and Theory 'Y' and William Ouchi's Theory 'Z' - The Behavioural Approach - Contingency Approach.

Managerial Roles, Levels of Management - Managerial Skills, Social Responsibilities of Business, Contemporary management issues and challenges.

Unit-II

Planning

Nature and Purpose of Planning, Planning Process, Types of Plans, Environmental Scanning – SWOT and PEST analysis, Objectives, Managing by Objectives (MBO), Strategies – Types of Strategies, The Strategic Planning Process, The TOWS (Threats, Opportunities, Weaknesses and Strengths) Matrix, The Portfolio Matrix, Three Generic Competitive, Strategies by Porter, Effective Implementation of Strategies. Policies- Types. Decision Making – Types of Decision, Decision Making Process, Rational Decision Making Process, Decision Making under different Conditions.

Unit-III

Organizing

Importance and Principles of Organizing, Organization Structure – Functional Structure, Product Structure, Geographical Structure, Entrepreneurial Structure, De-centralised Structure, Strategic Business Struture, Matrix Structure, Team Structure, Virtual Structure, Line and Staff Structure. Departmentation, Span of Control, Centralization and Decentralization, Delegation of Authority.

Unit-IV

Staffing and Directing

Nature and scope of Staffing, Manpower Planing, Selection and Training, Performance Appraisal. Principles and elements of direction, Requirement of Effective Direction – Functions of Direction –Supervisor and his Qualities – Supervisor's Role and Functions – Effective Supervision.

Unit-V

Controlling

Concept, Process of Controlling, Types of control – Budgetary and non-budgetary control techniques – Requirements for effective control.

Significance of Co-ordination in Organizations, Co-ordination versus Co-operation, Barriers in Co-ordination, ways to achieve effective co-ordination.

Text Books:

1. Andrew J. Dubrin, "Essentials of Management", 9th edition, Thomson Southwestern, 2012.

2. Harold Koontz and Heinz Weihrich, "Essentials of management: An International & Leadership Perspective", 9th edition, Tata McGraw-Hill Education, 2012.
3. Charles W.L Hill and Steven L McShane, "Principles of Management", Special Indian Edition, McGraw Hill Education, 2007.

Suggested Readings:

1. Don Hellriegel, Susan E. Jackson and John W. Slocum, "Management- A competency-based approach", 11th edition, Thompson South Western, 2008.
2. Heinz Weihrich, Mark V Cannice and Harold Koontz, "Management- A global entrepreneurial perspective", 12th edition, Tata McGraw Hill, 2008.
3. Stephen P. Robbins, David A.De Cenzo and Mary Coulter, "Fundamentals of management", Prentice Hall of India, 2012.

16MB C102

MANAGERIAL ECONOMICS

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

Course Objectives: The Objectives of the course are:

1. To integrate the basic concepts of managerial economics and their role in decision making.
2. To focus on the demand and supply functions and analyse the concepts of elasticity of demand.
3. To execute the least cost combination of inputs through production function.
4. To analyse the role of cost, revenue and profit in decision making and Compute break even point.
5. To test price-output determination under different market conditions.
6. To apply Pricing methods and contemporary practices.

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

1. Defend the role of basic concepts of managerial economics in decision making.
2. Recommend the demand and supply functions and assess the elasticity of demand.
3. Conclude on the least cost combination of inputs through production analysis.
4. Compare different cost concepts and Predict the breakeven point.
5. Examine pricing decisions under different market conditions.
6. Formulate the Price for a given product or service.

Unit – I

Introduction

Nature and Scope of Managerial Economics, Definition, Fundamental Concepts of Economics: Opportunity Cost, Discounting principle, Time perspective, Incremental reasoning, Equi-marginal concept. Theories of firm- profit maximization theory, Baumol's sales revenue maximizing model, Berle-Means-Galbraith model of corporate power structure, Penrose's theory of firm, Simon's model of satisficing behaviour. Economics of information: Risk, Uncertainty, Asymmetry of information, Adverse Selection, Market Signalling. Economic optimization: profit maximization by the total revenue and total cost approaches, optimization by marginal analysis, optimization by substitution.

Unit – II

Demand and Supply Analysis

Definitions, Determinants of demand and supply, Demand and supply functions,demand and supply curves, Market equilibrium. Consumer behaviour and rational choice: cardinal and ordinal approaches of consumer utility. Maximization of consumer utility: technique of indifference curves and budget lines. International convergence of tastes.

Demand Sensitivity Analysis: Price, Income and cross elasticity's of demand. Managerial applications of elasticity of demand. (with simple numerical problem)

Unit – III

Production Analysis

Meaning of Production, Production Function; Laws of diminishing returns to a factor. Isoquants: meaning, types and properties, isoquant map, ridge lines, input prices and isocost line, Optimal combination of input factors: Expansion path and Returns to scale, Estimation of production function: Cobb Douglas and CES Production functions, Economies and Diseconomies of scale.

Unit- IV

Cost Analysis

Concepts of costs, theory of cost, cost-output function, determinants of cost function, relationship between production and cost, short run cost function, long run cost function, relationship between short run and long cost curves; Cost Volume Profit Analysis. (with simple numerical problem)

Unit – V

Market Structure and Modern Pricing Practices

Different types of market structure and its importance. Price determination under: perfect competition. Monopoly, Oligopoly and Monopolistic competition; sophisticated market pricing: price discrimination–using coupons and rebates, Peak load pricing, Pricing of multiple products; Transfer pricing; A perfectly competitive market for upstream product. The global use of transfer pricing, Pricing of Multiple products.

Text Books:

1. Dominik Salvatore, "Managerial Economics",7th edition, Oxford University Press, 2014
2. P.L.Mehta., "Managerial Economics-Analysis, Problems and Cases", 13th edition Sulthan Chand & Sons, 2014.
3. V.L.Mote, S.Paul and G.S.Gupta, "Managerial Economics Concepts and Cases",11th edition, Tata Mc Graw Hill Pvt. Ltd., 49th Reprint 2010.

Suggested Readings:

1. Geethika, Piyoli Ghosh, and P.R. Chaudhary "Managerial Economics", 2nd edition McGraw Hill, 2015
2. R.L.Varshney &K.L.Maheswari, "Managerial Economics",22nd Edition, Sultan Chand & sons, 2014.
3. Barry Keating & J.Holten Wilson, "Managerial Economics", 2nd Edition, Bizmantra, 2009.

16MB C103

FINANCIAL ACCOUNTING AND ANALYSIS

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

Course Objectives: The Objectives of the course are:

1. To generate the basic inputs on maintaining books of accounts and to monitor and test the accuracy of books of accounts through Trial Balance.
2. To construct the financial statements.
3. To critically evaluate financial statements through Ratio Analysis and interpretation.
4. To judge the flow of funds/cash through funds flow and cash flow statements.
5. To focus on IAS-IFRS-USGAAP.
6. To identify how to value the human resources in an organisation.

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

1. Maintain books of accounts.
2. Construct the financial statements.
3. Analyse and interpret financial statements through Ratio Analysis.
4. Critically identify sources and application of funds or cash.
5. Apply accounting standards while preparing the financial statements.
6. Carryout valuation of human resources of an organisation.

Unit–I

Introduction to Financial Accounting

Meaning and Definition of Financial Accounting - Accounting as a business information system; Parties interested in accounting information; Accounting Concepts and Conventions, their implications on accounting system; Double entry system: Recording of business transactions-classification of accounts-Accounting process-accounting cycle-primary entry (Journal Proper) – Ledger posting - preparation of Trial Balance, Suspense account.

Unit- II

Preparation and presentation of financial statements

Distinction between Capital and Revenue Expenditure - Measurement of business income, Preparation of Profit and Loss account, and Balance Sheet.

Concept of Depreciation - Methods of providing depreciation and its impact on measurement of business income.

Unit –III:

Financial Statement Analysis

Meaning of Financial statement analysis- tools of financial statement analysis- Ratio analysis-meaning, uses and limitations of ratio analysis-calculation and interpretation of ratios- Liquidity ratios-Profitability ratios-Solvency ratios- Leverage and Turn over ratios.

Unit-IV:

Funds flow and Cash flow analysis.

Concept of Fund- meaning of Funds flow, preparation of statement of changes in Working Capital, Funds from operations, statement of sources and applications of Funds. Funds Flow Statement. Cash flow statement-cash from operations- preparation of cash flow statement. Difference between funds flow and cash flow statements.

Unit-V:

Contemporary issues in Accounting

Accounting standards: Meaning and definition of accounting standards-their importance in accounting environment-IAS-IFRS-USGAAP.

Human Resources Accounting: concept and importance, objectives of HR accounting- Methods of Valuation.

Text Books:

1. Ambarish Gupta, "Financial Accounting for Management- An Analytical Perspective", Pearson, 2015
2. S.N Maheshwari and S.K. Maheswari: "Financial Accounting", Vikas, 2016.
3. Grewal T. S., "Introduction to Accounting", S. Chand, 2016.

Suggested Readings:

1. Earl k Stice and James. D. Stice, "Financial accounting-Reporting and Analysis", Cengage Learning, 2015
2. Carl S Warren, James. M. Reeve, Jonathan. E. Duchac, "Financial accounting, concepts, Methods and Applications",Cengage Learning, 2014
3. Alic C Lee, John C Lee, "Financial analysis, Planning & Forecasting", Cambridge, 2014.

16MB C104

MARKETING MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To provide an understanding of marketing evolution, concepts, environment and marketing strategy.
2. To enable students to identify and select effective segmentation, targeting and positioning strategies.
3. To focus on how a marketer can effectively utilize the marketing mix elements to attract and retain the customer.
4. To understand the importance of Strong branding and how to generate brand equity.
5. To determine how various marketing control techniques helps to effectively utilize marketing budget.
6. To focus on contemporary issues in Marketing.

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

1. Know the various philosophies of marketing, environment and strategy, and implement best marketing strategies through application of analytical concepts and decision making tools.
2. Understand various segmentation, targeting and positioning strategies to make their products as market leaders.
3. Design the marketing mix effectively in order to achieve the organizational goals and objectives.
4. Know the essential Branding strategies to conquer the market.
5. Control unproductive marketing expenditures.
6. Understand the contemporary issues and develop marketing strategies to sustain the business.

Unit- I

Introduction

Marketing, Market, Marketing Management, Tasks, Philosophies, Marketing Mix, Expanded Marketing mix, Marketing Program and Marketing Strategy, Managing marketing effort, Marketing environment Company's Micro and Macro environment, Marketing interface with other Functional areas.

Unit -II

Market Segmentation, Targeting and Positioning

Levels and bases for Segmentation, Segmenting Consumer markets, Segmenting Business markets, International markets, Market targeting-Evaluating and selecting Market segments, Differentiation- Positioning strategies, Competitive strategies.

Unit – III

Marketing Mix and Control

Decisions involved in Product, Packaging, Product line and mix decisions, New product development, Product life cycle, Pricing strategies, Distribution channels, Channel management decisions, Promotion mix-Advertising, Sales promotion, Public relations, Personal selling, Online marketing.

Marketing Control, Annual plan Control, Efficiency Control, Profitability Control and Strategic Control, Marketing Audit.

Unit – IV

Branding

Concept of Brand – Definition, Importance of Branding in Marketing commodity vs. Brand name, Brand Positioning and Repositioning. Brand Sponsorship – National Brands, Licensing, Co-branding, Brand development – Line extension, Brand extension, Multi brands, New brand. Managing brands – Brand loyalty, Brands equity, Brand cannibalization, Brand management practices.

Unit – V

Contemporary Issues in Marketing

Customer Relationship Marketing (CRM), Global marketing, e-marketing, marketing engineering, Green marketing, Societal Marketing, Viral marketing.

Text Books:

1. Kotler Philip, Garyarmstrong, Prafullay, Agnihotri, EU Haque, "Principles of Marketing", 13th Ed, Pearson Education Prentice Hall of India, 2010.
2. Rajan Saxena, "Marketing Management", 4th Ed. Tata McGraw Hill, 2009.
3. Ramaswamy V.S. Namakumari S, "Marketing Management", The Global perspective-Indian Context Macmillan India Ltd., 2009.

Suggested Readings:

1. Paul Baines, Chris fill, Kelly page, "Marketing Management", 1st ed. Oxford Univesity Press, 2009.
2. Roger j. best, "Market-Based Management", 1st Ed/ PHI Learning Pvt. Ltd., 2009.
3. Kurtz and Boone, "Principles of Marketing", 12th Ed. Cengage Publications, 2010.

SCHOOL OF MANAGEMENT STUDIES CBIT Hyderabad

16MB C105

STATISTICS FOR MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To provide an insight into the concepts and tools of Statistics.
2. To enable the students to understand measures of Central tendency and Measures of Dispersion.
3. To make students understand the concept of probability and apply different types of probability distributions.
4. To enable the students to decide the appropriate sampling techniques to be used for a given problem.
5. To facilitate for formulation of hypotheses and applying the parametric statistical tools to test the same and also interpret the results.
6. To enable the students to apply different forecasting techniques namely, correlation, regression and time series analysis.

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

1. Calculate measures of central tendency and measures of dispersion.
2. Apply principles of probability and different types of probability distribution.
3. Articulate the appropriateness of different types of sampling techniques.
4. Formulate hypotheses and test the same using appropriate parametric tools and interpret the results.
5. Test the given hypotheses using Chi-square and ANOVA and interpret the results.
6. Apply forecasting techniques using correlation, regression or time series analysis and analyse the results.

Unit –I

Introduction

Overview, origin and development of Statistics, Managerial applications of statistics. Measures of central tendency: Mean- Harmonic mean, Geometric mean , Median, Mode, Measurement Dispersion: Range and quartile deviation, mean deviation, standard deviation. Skewnes and Kurtosis.

Unit-II

Probability

i) Concepts and Definitions of probability. Additive and multiplicative Law of probability, Baye's theorem, Statistical independence. (simple numerical problems only)

ii) Random variables: Expectation and variance of a random variable, Probability distribution function, properties of discrete and continuous probability distribution functions.

1. Discrete probability distributions: Binomial distribution, Properties and applications - Poisson distribution, Properties and applications.

2. Continuous probability distributions: Normal distribution, Standard normal distribution, Properties and applications of Normal distribution.

Unit-III

Sampling and Estimation

1. Sampling theory: Sampling procedures-Random and Non-random methods, Sample size determination, standard error, Sampling error.

2. Statistical estimations: Point and interval estimation, Properties of good estimator, confidence interval.

Unit-IV

Hypothesis testing

1. 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.
2. Small sample tests: t- distribution- Properties and applications, Testing for one and two means, paired t- test.
3. Analysis of variance -one way and two way ANOVA (With and without interaction).
4. Chi-square distribution: Test for goodness of fit, Test for independence of attributes.

Unit – V:

Correlation, Regression and Time Series

i) Correlation analysis –Positive and negative correlation-limits for Coefficient of Correlation- 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-Components of time series-Models of time series-Trend analysis-Free hand curve method- Method of semi averages-method of moving averages- Least Squares method.

Text Books:

1. S.P.Gupta, "Statistical Methods", Sultan Chand & Sons, 2014 .
2. S.C.Gupta, "Fundamental of statistics", Himalaya, 2016.
3. R.I. Rubin S. David, "Statistics for Management", Pearson, 2014 .

Suggested Readings:

1. PN.Arora, Sumeet Arora, S.Arora"Comprehensive statistical methods", S.Chand co., 2015.
2. J.K.Sharma, "Business Statistics", Pearson, 2015.
3. Beri, GC, "Business Statistics", McGraw-Hill, 2015.

SCHOOL OF MANAGEMENT STUDIES CBIT Hyderabad

16MB C106

BUSINESS COMMUNICATION

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

Course Objectives: The Objectives of the course are:

1. To demonstrate knowledge of communication theory and application.
2. To empower the students with the necessary skills and techniques of business communication to handle business-related issues efficiently and effectively.
3. To familiarise the students with formal writing, construct appropriate messages, and build effective business relations through an effective communication.
4. To deliver appropriate communication skills across various business settings, purpose, and audience.
5. To focus on media relations and crisis communication.
6. To emphasize on technological, legal and ethical dimensions in business communication.

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

1. To enhance 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 behavior.
5. Build better relations with appropriate messages.
6. Communicate effectively leveraging technology in various settings and contexts.

Unit-I

Introduction

The role of and process of communication, Objectives of communication - gateways to effective communication – Organizational communication. Multi cultural and Global communication ; Listening process – Elements of good listening – improving listening competence. Importance of feedback – Principles of feedback.

Unit-II

Written Communication

Types of reports – Structure of reports – Individual and committee reports – Essentials of good report writing. Business letters – Drafting letters relating to enquiries and replies; orders and replies; complaints and claims. Effective business correspondence.

Unit-III

Presentation Skills

Presentations – elements of presentation, presenter, analyzing audience and content- non-verbal dimension of presentations- effective presentation strategies. Methods of speaking, speeches for commemorative occasions. Negotiations – Approaches to negotiations – preparing for and conducting negotiations.

Unit-IV

Non Verbal Communication

Characteristics, Importance, Types and functions of non verbal communication – preparing for job: Drafting a resume, participating in a Group discussion, job interview, types of interview, strategies for success at interviews – Business Etiquette, basic rules of Business etiquette.

Unit-V

Public Relations, Trends and Dimensions in Business Communication

Media relations – Building better relations with media. Investor relations – Framework for managing investor relations. Managing government relations – ways and means of managing governing power. Crisis communication. Do's and don'ts in the wake of a crisis.

Advances and Trends in Communication Technology, Legal and Ethical Issues in Business Communication. Social Media Communication.

Text Books:

1. Lesikar, R.V. and M.E.Flatley, "Basic Communication", New York, McGraw Hill, 2014.
2. P.D.Chaturvedi and Mukesh Chaturvedi, 'Business communication', Pearson education, 2012.
3. CSG Krishnamacharyalu and L.Ramakrishna, "Business Communications", Himalaya publishing house, 2014.

Suggested Readings:

1. Penrose, Rasberry and Myers, "Business Communication for Managers", Cengage Learning, 2007.
2. U S Rai & S M Rai, "Business Communication', Himalaya publications, 2014.
3. Mary Munter, "Guide to Managerial Communiciation" Pearson Education, 2013.

16MB C107

BUSINESS LAW

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

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.
2. To provide knowledge on general contracts.
3. To educate the students on special contracts, sale and negotiable instruments.
4. To discuss the formation of company, process, and dissolution.
5. To elaborate the rights of consumers and redressal mechanism.
6. To enlighten students on Intellectual property rights, competition law, cyber laws and legal environmental issues.

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

1. Identify legal issues and provide potential solutions to legal problems within the business environment.
2. Understand the legal principles of business law; apply such principles of law to problems associated with businesses and business transactions.
3. Understand special contracts and reflect on current legal issues; and how to use various negotiable instruments for various business transactions.
4. Understand the various provisions of Companies Act.
5. Claim the rights as a consumer and know the redressal mechanism.
6. Understand legal provisions contained in competition Law and Cyber Laws and the process in Intellectual Property Rights and RTI, and legal environmental issues.

Unit- I

Introduction

Definition of Contract and Agreement – Classification of Contracts, Essential elements of a valid Contract – Offer - Acceptance - Consideration - Capacity to Contract - Free consent-Performance of Contract – Remedies for breach of Contract - Quasi Contracts.

Unit - II

Law Relating to Special Contracts

Special Contracts - Salient features of Contract of Agency, Bailment and Pledge, Indemnity and Guarantee.

Sale of Goods Act – Distinction between Sale and Agreement to sell - Conditions and Warranties.

Negotiable Instruments Act – Definition, Characteristics, 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 - Share holders 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 – Right to Information - Consumer awareness - Consumer councils - Redressal machinery.

Unit-V

Miscellaneous Laws

Intellectual Property Rights – Patents, Copyright, Trademark. Competition Law. Cyber laws. Right to Information Act. Legal Environmental issues.

Text Books:

1. N.D. Kapoor, "Elements of Mercantile Law", 34th ed., Sultan Chand & Co.,2013.
2. K.R. Bulchandani, "Business Law for Management", 6th ed, HPH , 2014.
3. Akhileshwar Pathak, "Legal Aspects of Business", 3rd Ed. Tata McGraw Hill. 2007.

Suggested Readings:

1. PPS Gogna, "A Text Book of Company Law", S. Chand, 2010.
2. Satish B. Mathur, "Business Law", Tata Mc Graw Hill, 2010.
3. D.Chandra Bose, "Business Law", PHI,2010.

16MB C109

INFORMATION TECHNOLOGY – LAB

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

Course Objectives: The objectives of the course are:

1. To equip students with the usefulness of MS OFFICE in their work place.
2. To provide an insight of basic concepts of MS-EXCEL.
3. To understand different concepts using Charts for analyzing the data.
4. To Acquire knowledge on the various Statistical and Financial tools used in MS-EXCEL.
5. To understand the basic concepts of MS- ACCESS and MS-POWERPOINT for presentations.
6. To gain knowledge on web based tool-HTML.

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

1. Effectively integrate MS-Office modules in the work environment.
2. Analyze the basic concepts of MS-Excel and its computing requirements.
3. Apply statistical tools in their projects, research work also also in real life situations.
4. Demonstrate detailed knowledge on MS- Access.
5. Design various presentations with the help of MS-Power Point.
6. Engage in continuing professional development with web based tool.

Unit – I

Introduction to MS-EXCEL

Introductory concepts of MS-EXCEL spreadsheet: File options, Home options, Alignment of data, Defining the columns, Formatting – Table, Cell. Filtering techniques, Insert options – PIVOT table, Image, Special Symbols, Clipart. Charts – Line, Bar, Pie, Scatter. Page Layouts. Advanced Options of MS-EXCEL: a) Statistical tools – use statistical functions such as Mean, Median, Mode, Average, Standard Deviation, ANOVA, etc. b) Financial Tools – use of Financial Functions such as NPV, IRR etc. c) Date Functions d) Building Simple Macros.

Unit II

MS-Access and MS-Powerpoint

Introduction to MS-ACCESS: Creating a database and tables by different methods- Entering and Editing data- Sorting, Filtering and displaying data. Creating and querying using forms. Creating and printing reports and labels. Transfer of data between Excel and Access. MS- PowerPoint: Creating a presentation with themes, smart art, hyperlinks, styles, animation.

Unit III

Web Based Tool

Introduction to HTML: Simple HTML using Heading elements, Text Elements, Logical Styles, Physical Styles, Ordered, Unordered and Definition list, Hyper Links, Image Link to page containing Images and Videos File

Text Books:

1. David Whigham, "Business Data Analysis Using Excel", Indian Edition, Oxford University Press, 2010.
2. Steven Holzer, "HTML",Paraglyph press,Indian Edition, 2000.
3. Paul Cornell, "Accessing & Analyzing DATA with MS-EXCEL", 2003.

Suggested Readings:

1. R & D, "IT Tools and Applications", Macmillan India Ltd.
2. D.P. Apte, "Statistical Tools for Managers – using MS Excel", Excel Books, 2009.
3. P. Sudharsan & J. Jeyabalan, "Computers Systems & Applications", Jaico Student Edition- Jaico Publishing House.

3. K.Ashwathappa "Essentials of Business Environment: Text, Cases& Exercises" HPH, 2011.

16MB C112

HUMAN RESOURCE MANAGEMENT

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

Course objectives: The objectives of this course are:

1. To provide the basic concepts of Human Resource Management.
2. To make the students understand the process of recruitment and selection.
3. To introduce the concept of performance appraisal and its methods.
4. To understand the basics of Industrial Relations and its importance.
5. To enable the students in having a basic knowledge of Labour laws.
6. To introduce the ongoing 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 in working environment.
2. Implement good and innovative practices in recruitment and selection.
3. Involve in and Implement the process of Performance Appraisal in Organizations.
4. Maintain sound and updated Industrial Relations practices at workplace.
5. Involve in suggesting and implementing various labour acts as applicable.
6. Design and develop 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 - Jobs and careers in 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 - Basic components of Compensation Management - Towers Perrin Model of Total Reward - Career planning – Greenhaus Career Development Model - Psychological Contract: Functions and Types – HR Utility Framework – Markov Employee Transition.

Unit – IV

Industrial Relations

Industrial Relations - Definition, Importance, Basics of Industrial Acts - Factory Act 1948, Trade Union Act 1926, Employee State Insurance Act 1948, Workmen Compensation Act 1923, Industrial Employment (Standing orders) Act 1946, Industrial Disputes Act 1947, Minimum Wages Act 1948 - Dunlop's IR Model – Quality of work life - Grievance management - Collective Bargaining - Negotiation– Labor Turnover and stability indices – Worker's Participation in Management– Bate's brand wheel for employer brand – Employee Engagement Index – Employee Value Proposition – Absence Management – Brad factor.

Unit – V

Contemporary Issues in Human Resources Management

Introduction to Change Management - HR outsourcing , HR issues in mergers and acquisitions - Work life integration – Introduction to International HRM, Strategic HRM in a Changing Environment - HRIS: Three Levels - Diversity Management - Succession Planning - Stress Management - Ethics in HRM, Interpersonal relations in the workplace - HR Research.

Text Books:

1. Gary Dessler, "Human Resources Management", Pearson, 2015.
2. Decenzo, "Human resources Management", Wiley, 2015.
3. Michael Armstrong, "Human Resource Management", Kogan Page, 2015.

Suggested Readings:

1. David Lepak, Mary Gower, "Human Resource Management", Pearson, 2015.

16MB C113

FINANCIAL MANAGEMENT

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

Course Objectives: The objectives of this course are:

1. To explain the nature and scope of finance function and calculate time value of money.
2. To evaluate capital budgeting techniques based on profitability.
3. To analyse the sensitivity of EPS to PBIT under different capital structures.
4. To determine the cost of capital.
5. To analyse how dividend decisions influence financing decisions.
6. To estimate working capital requirements and manage current assets.

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

1. Judge time value of money in terms of annuity, present value for even and uneven cash flows.
2. Assess the feasibility of capital budgeting proposals based on profitability.
3. Evaluate the capital structure decisions.
4. Compare cost of equity, debt and weighted average cost of capita.
5. Argue the dividend decisions and explore their role in financing decisions.
6. Assess working capital requirements with particular reference to cash, debtors, inventory management.

Unit-I

Introduction

Nature and scope; finance function; Goals of finance- profit maximizing vs wealth maximization, Risk- Return trade off; Agency problem: managers vs shareholders goals; concept of Time value of Money- future value : single cash flows, annuity; present value: single cash flows, annuity, uneven cash flows, multi period compounding. (simple problems)

Unit-II

Investment Decision

Investment Decision Process, Developing Cash Flows; Evaluation techniques-Traditional and DCF techniques. Capital budgeting under risk and uncertainty: Risk adjusted discount rate, Certainty Equivalents, Probability Tree approach. (Problems and cases), capital rationing. (theory)

Unit-III

Financing Decision

Sources of finance; Leverage-concept of leverage-operating leverage-financial leverage- combined leverage; EBIT-EPS analysis.

Capital structure theories- Net Income approach- Net operating Income approach- Traditional view- MM hypothesis.

Cost of Capital: 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- cash and Bonus shares; Dividend theories: relevance and irrelevance dividends- Walter's model- Gordon's Model- 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 edition Vikas Publishing House, 2015
2. Khan, M.Y. & Jain P.K "Financial Management", 7th edition McGraw Hill, 2016.
3. Prasanna Chandra, "Financial Management Theory and Practice", 9th edition McGraw Hill, 2015.

Suggested Readings:

1. Brigham, E. F. and Ehrhardt. M. C., "Financial Management Theory and Practice", 11th edition Thomson South-Western, 2015.
2. Jonathan Berk, Peter DeMarzo, Ashok Thampy, "Corporati Finance", 4th edition, Pearson, 2014.
3. Ross Westerfield Jaffe, "Modern Financial Management",10th edition, McGraw-Hill, 2015.

16MB C114

BUSINESS RESEARCH METHODS

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

Course Objectives: The objectives of this course are:

1. To provide understanding and application of appropriate research designs, research statistics, and the use of the computer for data analyses, and report writing and presentation.
2. To develop understanding of the basic framework of research process, designs and review of literature.
3. To identify and select various sources of data, sampling methods and be able to construct an effective questionnaire.
4. To acquaint students with the basic ideas, applicability, and methods of nonparametric tests.
5. To provide students with a working knowledge of the basic concepts underlying the most important multivariate techniques.
6. To provide guidance on how to write a report so that the information is easy to understand.

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

1. Gain knowledge of the business research methods and able to formulate the research problem, develop research design, analyze the data, draw interpretations and present the research findings.
2. Students will understand the research process, gap, and to compare and contrast various research design methods.
3. Students will be able to design the sample and assess measurement and scaling options to determine appropriate measures required to address specific research questions.
4. Apply and interpret the different type's of non-parametric statistical techniques.
5. Students will gain insights on how the methods are developed and gain ability to analyze multivariate data with appropriate methods.
6. Effectively communicate research in a written report and presentation.

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Unit – I

Introduction

Business Research - Meaning and Importance. Review of Literature, Research gaps. Research design- Exploratory, Causative, Conclusive and Experimental designs.

Unit – II

Sampling and Data Collection

Sources and methods of gathering information. Sampling design and Sample size determination. Design of Questionnaire. Concept of Measurement and Scaling – Nominal, Ordinal, Interval and Ratio Scales, Attitude scales Thurstone's, Likert's, Guttman's, Semantic differential. Reliability and Validity of scales.

Unit – III

Data Analysis

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. Multiple Regression (Numerical with two independent variables).

Unit – V

Report Writing

Preparation of the Report- Evaluation of the Research Report. Presentation of report: Plagiarism- Communicating the Research results.

Text Books:

1. Donald R Cooper and Pamela S Schindler, "Business Research Methods",11/e, TMH, 2013.
2. J.K.Sharma, "Business Statistics-Problems and Solutions", Pearson, 2010.
3. Deepak Chawla and Neena Sondhi,"Research Methodology Concepts and Cases", Vikas Publication, 2016.

Suggested Readings:

1. William G.Zikmund, "Business Research Methods", 8th Edition, Sengage Publishers, 2003.
2. Alan Bryman and Emma Bell, "Business Research Methods", 2nd Ed. Oxford Press, 2009.

16MB C115

OPERATIONS RESEARCH

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

Course Objectives: The objectives of this course are:

1. To provide an insight into the concepts and tools of Operations Research.
2. To apply the concept of linear programming and simplex method to a given situation with certain constraints.
3. To explain how the transportation and assignment problems can be solved with a focus on optimisation.
4. To determine the expected monetary value and expected value of perfect information in different business situations such as risk and uncertainty.
5. To explain how the probability of completing the project within given time for a given PERT Network and also analyse how to determine the total cost of crashing for a given project.
6. To apply a) queing theory as part of assessing the quality of service b) simulation techniques for evaulating variety of models and systems c) game theory to identify the winning strategies.

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

1. Apply Linear Programming and Simplex method to a given situation with certain constraints.
2. Solve the transportation and assignment problems.
3. Determine the expected monetary value and decide on expected value of given information in different business situations such as risk and uncertainty.
4. Determine a) the probability of completing the project within given time for a given PERT Network and b) the total cost of crashing for a given project.
5. Assess the quality of service interms and reduce the idle time using the concepts underlying queing theory.
6. Evaluate the simulation models and foromulate the winning strategies using game theory.

Unit – I

Introduction to Operations Research and Linear Programming

Operations Research : Introduction,origin, nature, definition, managerial applications and limitations.

Linear Programming: Mathematical model, Formulation of LPP, assumptions, solution by the graph, LP Problem -Simplex Method-Maximization and Minimization cases. Formulation of Dual to Primal.

Unit – II

Transportation and Assignment

Transportation: Formulation of Transportation Problem Mathematical model, IBFS using Northwest Corner Rule, Row and Column Minimum methods, Least Cost Method (LCM) and Vogel's approximation method, Unbalanced TP, Degeneracy, Optimality Test.

Assignment: Formulation of Assignment Problem (AP): Mathematical model, Balanced and Unbalanced Assignment problems, Restricted AP, Hungarian method. Travelling salesman problem, Managerial applications.

Unit – III

Statistical Decision Theory

Decision Theory-Decision making under Certainty, Risk, Uncertainty, Criteria of Decision making - Pessimism, Realism, Optimism, Regret, Equi-probable, EMV, EOL, Cost and value of information, Determination of EVPI utility as a concept of Decision Making.

Unit – IV

Network Analysis

Network fundamentals - scheduling the activities - PERT Vs CPM – Three time estimates - Beta distribution - Identifying Critical Path – Probability of Completig the project with in given time, Critical Path Method – Direct costs and indirect costs - cost slope- Crashing,

Unit – V

Queuing, Simulation and Game Theory

Queuing Theory - Concepts of Queue/Waiting Line - General structure of a Queuing system - Operating characteristics of Queues, deterministic Queuing models - 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. (Theory only)

Game Theory - concepts, saddle point, Dominance, Zero-sum game, two, three and more Persons games, analytical method of solving two person zero sum games, graphical solutions for (m x 2) and (2 x n) games.

Text Books:

1. A C S Kumar, "Operations Research", Yesdee, 2015.
2. Levin, "Quantitative Approaches to Management" McGraw-Hill, 2015.
3. J.K. Sharma, "Operations Research Theory and Applications" , Macmillan, 2015.

Suggested Reading:

1. N.D. Vohra, "Quantitative Techniques in Management", McGraw-Hill, 2015.
2. Prem Kumar Gupta & others, "Operations Research", S. Chand, 2015.
3. Pannerselvam, R, "Operations Research", PHI, 2015.

SCHOOL OF MANAGEMENT STUDIES
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16MB C116

OPERATIONS MANAGEMENT

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

Course Objective: The objectives of this course are:

1. To gain an understanding and appreciation of the principles and applications relevant to the planning, design, and operations of manufacturing or service firms.
2. To familiarize the concepts of operations management to students and make them understand the functions of inter related activities and decisions involved therein for effective operations management.
3. To gain some ability to recognize situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making on operations management and strategy.
4. To develop skills necessary to effectively analyze and synthesize the many inter-relationships inherent in complex socio-economic productive systems.
5. To understand how Enterprise Resource Planning and MRP II systems are used in managing operations.
6. To emphasize on the international operations management.

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

1. Apply knowledge of fundamental concepts of operations management for operational performance improvement.
2. Identify the operational and administrative processes in organizations and the boundaries of an operations system, and recognize its interfaces with other functional areas within the organisation and with its external environment.
3. Develop an integrated framework for strategic thinking and decision making to analyze the enterprise as a whole with a specific focus on the wealth creation processes.
4. Emphasize on the work study and measurement of work.
5. Give a clear knowledge on how materials and stores management are handled.
6. To identify future challenges and directions that relate to operations management to effectively and efficiently respond to market changes.

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. Production Planning and Control: Basic functions of Production Planning and Control, Production Cycle, characteristics of process technologies- Project, Job Shop, Assembly, batch and Continuous flow –Productivity-Measuring productivity-Ways of improving productivity -Emerging trends and implications for 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 - Plant Capacity and Line Balancing - Plant Layout- Different types of layouts- location and the factors influencing location. Maintenance Management: Objectives, Preventive and Breakdown maintenance, failure concept, Reliability, Replacement policies.

Unit – III

Work Study and Measurement

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 the Methods Study for identifying the most appropriate method. Work measurement - its uses and different methods, computation of allowance and allowed time.

Unit – IV

Materials and Stores 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-make or buy decisions and its implications under various circumstances Vendor rating - determinants of vendor rating. Objectives of Stores Management – Management of Stores - safety stock Inventory Control - Different Systems of Inventory Control, Types of Inventory. Costs- Systems of inventory control. Value Analysis: importance in cost reduction – concepts and procedures.

Unit – V

Quality Management

Quality -Need for quality - Evolution of quality, Quality Dimensions – Product and Service. The concept of TQM, Evolution of TQM – TQM

Framework – Conventional vs total quality management. Service Quality-significance. Quality Costs.

Note: Problems to be discussed in Units-2 & 4.

Text Books:

1. Stevenson J. William, "Operations Management", 11th Ed., Tata McGraw-Hill, 2012.
2. Mahadevan. B, "Operations Management", 2nd Ed, Pearson Education, 2010.
3. Dale H. Besterfield, Carol Besterfield - Michna, Glen H Besterfield and Mary Besterfield-sacre, "Total Quality Management", 3rd Ed., PHI, 2006.

Suggested Readings:

1. Robert S. Russel, Bernard W III Taylor, "Operations Management", 7th Ed Hoboken, Wiley, 2011.
2. Lee J., Krajewski,"Operations Management",9 edition, PHI, 2009
3. Everett. Adam, Jr. and Ronald J. Elbert, "Production and Operations Management Concepts", 5th Ed,Prentice-hall, 2006.

16MB C117

BUSINESS ANALYTICS

Instruction	3 hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 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.
2. Understand the role of business analytics within an organisation.
3. To acquire knowledge on data warehousing concepts.
4. Analyse data mining techniques and understand relationships between the underlying business process of an organisation.
5. Acquire knowledge on prescriptive analytics.
6. To understand the various applications of business analytics on different domains.

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

1. Have a clear idea about the basic concepts of business analytics in an organisation.
2. Demonstrate detailed knowledge about the role of business analytics in decision making.
3. Distinguish between descriptive, predictive and prescriptive analytics.
4. Gaining knowledge on dataware housing and data mining concepts.
5. Understand the usefulness of business analytics in various functional areas of an organisation.
6. Understand the future directions for business analytics.

Unit- I

Introduction

Introduction to Analytics, data science, Big data. Business analytics-challenges from outside and within, BASP (Business analytics success pillars) framework, Applications of Analytics to different domains, Data, Information, and Knowledge, Analyst's Role in the BA Model - Three Requirements the Analyst Must Meet , Required Competencies for the Analyst , Hypothesis-Driven Methods, Data Mining with Target Variables , Explorative Methods.

Unit- II

Descriptive analytics

Descriptive analytics-Data warehousing-concepts, characteristics, Data marts, Meta data and process of data warehousing, Business Reporting.

Visual Analytics and Business performance measurement, Why a Data Warehouse, Architecture and Processes in a Data Warehouse, Tips and Techniques in Data Warehousing.

Unit- III

Predictive analytics

Introduction, Data mining concepts and Applications, Data mining process, methods, classification techniques. Text mining-introduction, text analytics and sentiment analytics. Web mining-introduction, Web analytics and social analytics.

Unit- IV

Prescriptive analytics

Introduction- categories of models- optimisation, simulation, heuristics, predictive models, other models. Automated decision systems and Expert systems, Knowledge Management and collaborative systems.

Unit-V

GIS

Nature of Geographic data, Spatial Objects and Data Models, Getting map on Computers, GIS standards and Standardization Process of GIS development, Implementation and Deployment phases, Big Data, Defining Big Data, Big Data Landscape, Business Implications of Big Data, Technology Implications of Big Data, Big Data Technologies, Management of Big Data.

Text Books:

1. Ramesh sharada, Dursun Delen, Efraim Turban, "Business intelligence and analytics", Pearson, 2015.
2. Jean paul isson, Jesse S.Harriot, "Win With Advanced Business Analytics", Wiley and Sas, 2012.

Suggested Readings:

1. Gert H.N. Laursen, Jesper Thorlund, "Business Analytics for Managers", JohnWiley & Sons Inc., 2010.
2. George B. Karte, "The GIS Book".

16MB C118

STATISTICAL SOFTWARE 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 the course are:

1. To familiarise the students about the data summarisation and presentation.
2. To describe the concepts of measures of central tendency and dispersion.
3. To determine hypotheses formation and testing.
4. To educate how parametric and non-parametric tests are applied.
5. To focus on the importance of ANOVA.
6. To educate how forecasting techniques can be used and find trends values.

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

1. Analyze the data to draw inference for decision making.
2. Understand application of statistical measures of central tendency.
3. Test given set of hypotheses.
4. Understand the applications of parametric and non-parametric test.
5. Understand application of ANOVA.
6. Forecast unknown variable and analyze trends.

Unit –I

Introduction to MS-Excel

Components of an Excel spreadsheet- Entering Data and Formatting, Performing Calculations, Presenting Results, Numerical Skills Revision, Visualizing and Presenting Data-The Different Types of Data Variable, Graphical Representation of Data.

Unit-II

Averages and Measures of Dispersion

Measures of Central Tendency - Mean, median, and mode; Measures of Dispersion -The range, the interquartile range and semi interquartile range, standard deviation and variance, Coefficient of variation, Population Confidence Intervals.

Unit-III

Parametric and Non-Parametric Hypothesis Testing

3.1. Z Test, T Test, F Test, Chi Square Tests - independence of attributes

3.2. The sign test, Wilcoxon signed rank sum test and Mann-Whitney U test for two independent samples.

Unit-IV

Factorial Experiments and Correlation

4.1. Single-Factor Experiments - Single-factor ANOVA (or one-way ANOVA) and Kruskal-Wallis test.

4.2. Correlation Analysis - Scatter plot, Covariance, Pearson's correlation coefficient, testing the significance of Pearson's correlation coefficient, Spearman's rank correlation coefficient.

Unit-V

Regression and Time Series Analysis

Fitting a straight line using sample data, Time series: forecasting Method of least squares, moving average method. Inference and discussion of results.

Text Books:

1. Glyn Davis & Branko Pecar "Business Statistics Using Excel" Oxford University Press, 2012.
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.

Suggested Readings:

1. Bruce Bowerman, "Business Statistics in Practice", 5/e,TMH, 2012.
2. Shelly, "MS Office, 2007", Cengage, 2009.
3. Ajai.S.Gaur, Sanjaya S.Gaur, "Statistical Methods For Practice and Research", Response, 2009.

16MB C120

STRATEGIC MANAGEMENT ACCOUNTING

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

Course Objectives: The objectives of the course are to develop the knowledge and understanding of:

1. Strategic Management Accounting and application of marginal costing for decision making.
2. Strategic Planning and standard costing and variance analysis.
3. Concepts of Budgetary Planning and Control System.
4. Activity based Costing and Customer account profitability analysis.
5. Identify the costs involved at different stages of the life cycle.
6. Target cost in manufacturing and service industries.

Course Outcomes: After completion of the course, students should be able to:

1. Gain knowledge on Management accounting concepts and its function.
2. Utilize a variety of costing techniques in a range of practical business situations.
3. Understand the standard setting process and the ability to calculate, interpret and analyse appropriate variances.
4. Apply ABC and CAP techniques in planning, control and decision making situations.
5. Analyse the implications of lifecycle costing on pricing, performance management and decision-making.
6. Analyse the implications of using target costing on pricing and cost control.

Unit – I

Introduction

Meaning – Nature, Scope and Strategic importance of Strategic Management Accounting-Management function and management accounting. Marginal costing and its uses for decision-making, Make or buy–Profit planning- Acceptance of Export order- Optimization of sales mix/product mix–Discontinuation of product line.

Unit – II

Strategic Planning and Accounting for Control

Strategic Planning: Management Control and Operational Control–Meaning, Concept and Purpose. Standard costing - concept and purpose of standards- Types of standards. Variance analysis: Material variances, Labour variances, Overhead variances, Sales and profit variances.

Unit – III

Budgetary control and Responsibility Accounting

Budgetary control – Meaning and purpose – Essentials of effective budgeting program–Preparation of functional budgets: Sales budget, Production budget, Material Vs Purchase budget - Flexible budget - Zero based budgeting. Responsibility accounting - Meaning- Responsibility Centres, Types of responsibility centres – Need for divisionalization, Segmented Performance evaluation of divisions.

Unit – IV

Activity Based Costing and Customer Account Profitability Analysis

Activity Based Costing systems – Meaning – Types of Cost drivers – Activity based Management – Activity Based Costing vs Traditional costing. Customer Account Profitability analysis – Meaning and need for CAP analysis, Managing Customer Profitability.

Unit – V

Strategic decisions for Product life cycle and Competitor analysis

Product life cycle costing – PLC assessment – Cost assessment – Pricing and evaluation criteria for products at different stages of PLC. Competitor Analysis – Concept and Importance.

Text Books:

1. Ward. K, "Strategic Management Accounting", Butterworth Heinemann, New Delhi, 2010.
2. Hansen & Mowen, "Management Accounting", Cengage Learning, New Delhi, 2013.
3. Prof. Jawaharlal, "Advanced management accounting", 3rd ed., S.chand, 2009.

Suggested Readings:

1. Ronald.W.Hilton, G.Ramesh & M.Jayadev, "Managerial Accounting", Tata McGraw-Hill, 2008.
2. Edward J. Blocher, Kung H. Chen, Gary Cokins and Thomas W. Lin, "Cost Management-A strategic Emphasis", Tata McGraw Hill, 2006.
3. Khan M.Y. and Jain. P.K., "Management Accounting – Text, Problems and cases", 4th edition, Tata McGraw Hill, New Delhi, 2007.

16MB C122

STRATEGIC MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To help the students to understand the process of strategic management and strategic intent.
2. To enable the students to analyze internal and external environment and the strength of portfolio of the firm.
3. To develp the students to formulate strategies at the corporate level.
4. To make the students to craft business level strategies.
5. To provide knowledge on implementation of the strategies.
6. To create an awareness on how to take care of control and feedback.

Course outcomes: After completion of the course, students will be able to:

1. Display a knowledge of process of strategic management.
2. Appreciate the importance of strategic analysis in formulating strategy.
3. Generate and evaluate strategic alternatives at the corporate level.
4. Generate and evaluate strategic alternatives at the business level.
5. Construct strategy-implementation plans at the corporate level with appropriate controls and governance processes.
6. Construct strategy-implementation plans at the functional level with appropriate controls and governance processes.

Unit: I

Introduction

Nature, Scope, and process. Benefits and Limitations of strategic management. Levels of strategy- Developing strategic intent: vision, mission, goals and objectives, policies. Elements of strategy: the strategic position, strategic choices and strategy in action.

Unit: II

Strategic Analysis

External Environment analysis: key drivers of change, Porter's Five Forces Model. Industry and Competitive Analysis: Strategic groups, SWOT Analysis. Internal Analysis: Strategic capabilities, core and distinctive competencies, Creating and Sustaining Competitive Advantage, Porter's value chain; ~~Portfolio Analysis:~~ BCG Matrix, Ansoff's matrix, ADL matrix and GE model.

Unit: III

Corporate Level Strategic Alternatives

Stability Strategies: Maintenance of status quo strategy, Sustainable growth strategy, Pause/Proceed with caution strategy, No change strategy and Profit strategy. Growth Strategies: Internal growth strategy, Concentration strategy, Merger and Acquisition strategy, Diversification, Joint Ventures. Retrenchment Strategies: Turnaround strategy, Captive company strategy, Transformation strategy, Divestment strategy and Liquidation strategy. Combination/Portfolio Restructuring Strategy. Strategic Alliance.

Unit: IV

Business Unit Level Strategic Alternatives

Michael Porter's Generic Strategies: Cost Leadership, Differentiation and Focus strategies; Grand Strategies: Stability, expansion, retrenchment and combination. Offensive and Defensive Strategies. Industry Life Cycle Stages: Strategic Implications. Tailoring strategy to fit specific industry and company situations-Strategies for competing in Emerging industries, Turbulent and high velocity markets, Maturing industries, Stagnant industries, and Fragmented industries. Strategies for Industry leaders, Runner-up firms, weak and crisis ridden Business.

Unit V

Implementation, Control and Feedback

Matching organization structure and strategy. Behavioral Implementation: Culture and Strategy. Strategy and Leadership, Organization Development and Strategy. Functional Implementation: Role of Finance, Marketing, Human Resource, Production, Research and Development and Information Technology Departments. Types of Control: Preliminary, Concurrent, and feedback. Corporate Governance for Sustainable Development.

Text Books:

1. Arthur A Thompson Jr, Strickland A.J., John E. Gamble and Arun K. Jain, "Crafting and Executing Strategy - The Quest for Competitive Advantage - Concepts and Cases", Tata McGraw Hill Education Private Limited, New Delhi, 2015.
2. Azhar kazmi and Adela kazmi,"Strategic Management", McGraw-Hill, 2016.
3. Arabinda Bhadari and Raghunath Prasad Verma,"Strategic Management—A Conceptual Framework", McGraw Hill Education, 2013.

Suggested Readings:

1. Gerry Johnson, Kevan Scholes, Richard Whittington, "Exploring Corporate Strategy", 8th ed., Pearson, 2008.
2. Michael Hitt, Ireland, Hoskission, "Strategic Management", 9th ed, Cengage Learning, 2016.
3. Fred R. David, "Strategic Management – Concepts and Cases", 12th ed., PHI Learning, 2009.

16MB C124

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To facilitate the students to plan a career in business to get benefitted from a clear understanding of the field of Logistics and Supply chain management.
2. To make the students understand the importance of supply chain management for the success of any organization.
3. To focus on the role of logistics in the success of supply chain of an organization.
4. To elucidate how warehousing and transportation contribute for the success of any supply chain.
5. To facilitate students understand the strategic issues of supply chain.
6. 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. Equipped with the concepts of supply chain management to set their business successfully.
2. Learn the strategic importance of good supply chain design, planning and operation and also able to understand how supply chain can be a competitive advantage of a firm.
3. Understand how to manage the logistics for the success of an organization.
4. relate the importance of managing warehousing and transportation in a good supply chain.
5. Make strategic decision through alliances, collaborations and bench making practices.
6. Integrate various functional areas in order to have an effective supply chain.

Unit - I

Introduction

Introduction to Supply Chain Management (SCM) - Concept, evolution, Objectives, importance and function of SCM, conceptual framework of SCM, process view of supply chain , supply chain strategies, drivers and metrics of SC. Strategic fit, Achieving strategic fit and obstacles. Service Supply Chain Management

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, Factors influencing the decision making process of outsourcer.

Unit - III

Transportation and Warehousing

Transportation in SC, 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.

Unit - IV

Strategic Issues in Supply chain

Strategic Partnerships, Alliances and Collaborative advantage, Strategic relationships in-logistics, Supply Chain Coordination, Bullwhip effect, Bench marking - Issues and problems in Bench Marking, types of bench marking, methods of BM, Process of BM. Lean Manufacturing, Agile Manufacturing.

Unit - V

Supply Chain Interface

SC Network Design, Distribution network in SC, Channel design, factors influence design, Models in distribution network, SC integration - Internal and external, Role of IT and HR in SCM, Retailing and SCM.Pricing and Revenue Management, Green Supply chain Management

Text Books:

1. Chandrasekaran. N, "Supply Chain Management process, system and practice", Oxford, second Impression, 2012.
2. B. Rajashekar and G.V.R.K. Acharyulu, "Logistics and Supply chain Management", 1st edition Excel Books, 2009.
3. K. Shridhara Bhat, "Logistics and Supply Chain Management", 1st Ed. Himalaya Publishing House, 2016.

Suggested Readings:

1. Sunil Chopra, Peter Meindl& D.V.Karla, "Supply Chain Management, Strategy, Planning and Operations", 5th Edition, Pearson, 2013 .
2. Shah, J, "Supply Chain Management, Text and Cases", 2nd Ed., Pearson, 2011.
3. Crandall, Richard E & others, "Principles of Supply Chain Management", 2nd edition CRC Press, 2010.

16MB C125

ENTREPRENEURIAL DEVELOPMENT

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

Course objectives: The Objectives of the course are to:

1. to sensitise the students about the concept and functions of entrepreneur with particular reference to women entrepreneur and financial inclusion.
2. to educate on how to identify the business opportunities and provide orientation to social entrepreneurship and Entrepreneurship Development Programmes.
3. to provide insight on how to formulate business model and revenue model.
4. to explain how to optimize risk and return while leveraging technology.
5. to create an awareness on how to raise funds from the appropriate institutional sources under suitable schemes.
6. to enable the students to understand the role of venture capitalists in entrepreneurship development.

Course Outcomes: After completion of the course, student will be able to:

1. Understand the concept of entrepreneurship and its close relationship with enterprise and owner-management.
2. Identify the business opportunities.
3. Learn the concepts of innovation and creativity and the roles that both play in entrepreneurship and business development.
4. Manage the enterprise with a focus on project management.
5. Explore the avenues for institutional finance.
6. Identify the appropriate agencies for venture capital funding.

Unit–I

Introduction

The Concept and characteristics of Entrepreneur–Entrepreneur Vs.Intrapreneur– Functions of an Entrepreneur–Theories of Entrepreneurship- Role of Small Enterprises in Economic Development, Their problems -Women Entrepreneurship, Issues and Challenges of women Entrepreneurs – Entrepreneurs and Financial Inclusion - Select case studies.

Unit–II

Identification of Business Opportunities

Sources of business or product ideas steps in identification of business opportunity, Entrepreneurship Development Programmes (EDPs) - Digital Entrepreneurship – Social Entrepreneurship – Serial entrepreneurs - Rural Entrepreneurship. Business Plan, Development, Preparation and Evaluation.

Unit – III

Managing Enterprise

Interface with Functional areas. Strategies to set and achieve goals- Formal and non-formal aids - dealing with Government/non - Government organisations. Micro and Small, medium and large Enterprises (MSME Act) – Definition, Characteristics, Selection of business opportunities – formulating business and revenue models – Leveraging Technology - Optimising the risk and return.

Unit – IV

Institutional Finance

Definition, Characteristics, Government Policy, State and Central Government Initiatives need and importance, Institutional finance from IDBI, IFCI, LIC, UTI, NABARD, SFCs, SIDC s, EXIM Bank. Role of NSIC, SSIB, SSICs. Social Inclusion.

Unit – V

Startup andVenture Capital

Startup 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 capitalists.

Text Books:

1) E. Gordon & K.Natarajan,"Entrepreneurship Development", Himalaya, 2017.
2) Coulter,"Entrepreneurship in Action", PHI, 2008.
3) S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Ltd, 2007.

Suggested Readings:

1) Vijay Sathe, " Corporate Entrepreneurship" 1st edition, Cambridge, 2009.
2) Vasanth Desai, "Dynamics of Entrepreneurial Development and Management", HPH,Millenium Edition, 2007.

3) P. Narayana Reddy, "Entrepreneurship – Text and Cases", 1st Ed. Cengage Lerning, 2010.
4) David H. Hott, "Entrepreneurship New Venture Creation", PHI, 2004.

16MB E101 (F)

INVESTMENT MANAGEMENT

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

Course Objectives: The objectives of the course are:

1. To provides an in-depth analysis of the securities industry.
2. To provide the basic concepts of investment and its various investment opportunities.
3. To enable the students to acquire knowledge on investment analysis like fundamental and technical anlaysis.
4. To focus on the basics of bonds and world of fixed income investing.
5. To emphasis on the basis of the analysis and valuation of common stocks.
6. To provide an insight of portfolio theories and evaluation.

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

1. Pursue a career in the investment field, the course will prove useful for personal investing as well.
2. Have a clear idea about the investment management.
3. Gain knowledge on various investment avenues.
4. Analyse various techniques and tools in fundamental and technical analysis.
5. Allocate investments into stocks and bond portfolio's in accordance with a person's risk preference.
6. Understand various portfolio theories and its evaluation.

Unit – I

Introduction

Investment decision process; Concept; Real vs. Financial assets; Sources of investment-information; Investment vs. Speculation; Factors to be considered in investment decision.The concept and measurement of return-The concept and Measurement of Risk and Return-Range, Standard Deviation and Co-Efficient of Variation.Ex-ante and ex-post returns. Risk-return trade-off.

Unit – II

Investment Analysis

Approaches to Investment analysis-Fundamental Analysis-Economy, industry and company analysis –Factors of EIC analysis, Technical Analysis

- Dow theory, charts, moving averages, Relative strength, Efficient Market Hypothesis.

Unit – III

Fixed Income Securities

Features and types of debt instruments, 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.

Unit – IV

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.

Unit – V

Portfolio Theory and Evaluation

Concept of portfolio. Portfolio return and risk. Harry Markowitz's Portfolio theory, construction of optimal portfolio, the single-index model. Capital market theory: Introduction of risk-free asset, Capital Market Line (CML), Separation theorem. Capital asset pricing model (CAPM): Security Market Line (SML). Arbitrage Pricing Theory (APT): The Law of one price, two factor arbitrage pricing. A synthesis of CAPM and APT. Introduction to Mutul Funds. Performance measures - Sharpe's reward to variability index, Treynor's reward to volatility index, Jensen's differential index, Fama's decomposition of returns.

Text Books:

1. Charles P.Jones, "Investments Principles and Concepts",11th edition, Wiley India edition.
2. Prasanna Chandra, "Investment Analysis and Portfolio Management", TMH, 2010.
3. V.K.Bhalla , "Investment Management", 19th edition, S.Chand publications.

Suggested Readings:

1. Alexander. G.J, Sharpe.W.F and Bailey, J.V, "Fundamentals of Investments", 3rd ed, PHI.
2. Donald E. Fischer & Ronald .J.Jordan, "Securities Analysis and Portfolio management", 6th ed., McGraw Hill.
3. Harileela Vemula, "Security analysis & Portfolio management", Paramount Publishing House, New Delhi, 2014.

16MB E102 (F)

INTERNATIONAL FINANCE

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

Course Objectives: The Objectives of the course are:

1. To provide an extensive view of International Monetary Systems.
2. To enable the students understand the foreign exchange markets.
3. To give insights about how exchange rates are calculated in the spot and forward markets.
4. To focus on how financial decisions are made by MNCs in the global market.
5. To equip the students with the hedging techniques to manage the risk in the MNCs.
6. To provide basic platform on tax structures of MNCs in the International scenario.

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

1. Do business in a global setting by understanding the international monetary system.
2. Have insights about the structure and operations of foreign exchange markets.
3. Find exchange rates of any currency with respect to any other currencies.
4. Equip with the concepts of financial decision making in the MNCs.
5. Apply various tools for hedging to manage the risks faced in the international scenario.
6. Enrich with risk management techniques and tax environment in global environment.

Unit - I

Introduction

Evolution of International financial system–gold standard, Breton woods standard, floating exchange rate; currency board, sterilized and unsterilized intervention; Global financial institutions–IMF, Bank for International Settlements; International financial instruments–euro CP, Eurobonds, foreign bonds, global bonds, euro equity, ADR, GDRs.

Unit - II

Foreign Exchange Market and International Parity Relationships

Participants in Foreign exchange market, structure of Foreign exchange market in India; Foreign Exchange rates: quotes in spot and forward market, Cross rates, triangular arbitrage; Foreign Exchange Management Act ; BOP, BOP trends in India; Parity Conditions- Purchasing Power Parity, Interest Rate Parity, International Fisher Effect, Unbiased Forward Rate Theory.

Unit - III

Multinational Corporate Decisions in Global Markets

Foreign investment decision-Foreign direct investment (FDI)–motives, Modes of foreign investment–licensing, management contracts, joint venture, Greenfield investment, acquisition, strategic alliance, evaluation of overseas investment proposal using APV; International cash management, multinational capital structure decision, cost of capital.

Unit - IV

Risk Management in Multinational Corporations

Types of risk-currency risk, transaction exposure, translation exposure, accounting standard for translation exposure in India, economic exposure; risk management through hedging - natural hedges, hedges with currency derivatives – forward market hedge, options market hedge, money market hedge, hedging through invoice currency.

Unit - V

International Tax Environment

Types of tax–income tax, withholding tax, value added tax, Tobin tax; taxation methods – worldwide approach, territorial approach; tax havens, offshore financial centres, Tax treaties-Double taxation Avoidance agreement, multilateral tax treaties; foreign tax credit, tax neutrality tax equity, taxes and the location of foreign operations, tax implications of dividend remittance by overseas affiliate, Taxation of foreign source income in India; Transfer pricing (TP) and tax planning– TP methods, TP rules in India

Text Books:

1. Eun C.S., Resnick B.G., "International Financial Management", 4th ed. Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2008, reprint 2010
2. Shailaja G, "International Finance", Universities press, 2nd Ed. Orient Black'swan Pvt.Ltd., 2010.
3. Apte P.G., "International Finance", 2nd Ed. Tata McGraw Hill, 2009.

Suggested Readings:

1. Alan. C. Shapiro., "Multinational Financial Management", 9th Ed. PHI Pvt. Ltd., 2009.
2. Levi M., "International Finance", 5th Ed. Routledge, Taylor & Francis Group, 2009.

3. Madura J., "International Financial Management", 4th Ed. Cengage Learning, 2010.

16MB E103 (HR)

PERFORMANCE AND COMPENSATION MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To develop an understanding of the complexities in deciding compensation of employees.
2. To understand the importance of linking performance appraisal in determining compensation.
3. To discuss the importance of performance benchmarking in improving individual and organizational performance.
4. To understand the concept of compensation management and its importance in employee retention.
5. To introduce various methods of designing compensation system.
6. To make the students aware about the legally required and discretionary employee benefits.

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

1. Involve and in the future lead the process of performance planning.
2. Effectively use the existing performance appraisal methods at their workplace as an HR professional.
3. Set a 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. Design a new set of compensation system in the organization.
6. Maintain a proper balance of legally and discretionary benefits in the organisations.

Unit – I

Introduction

Definition, concerns and scope of Performance Management (PM). Determinants of job performance. Mapping, process, sequence and cycle of PM. Performance planning and Role clarity. KPAs - Performance Targets. Trait, Behavior and Results approaches to measuring performance. The impact of HRM practices on performance.

Unit – II

Performance Appraisal

Assessment center - 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 worksheet, Combining behavior and outcomes, Attribution theory-Causal matrix

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. PM Audit, PM pathway analysis. The impact of Performance Management on Line managers and Employees.

Unit - IV

Strategic Compensation Management Concepts

Compensation as an offshoot of performance- Concept of compensation- Exploring and defining the compensation context – System of compensating – compensation dimensions – Role of compensation in Organization - stake holders of compensation-factors influencing compensation- Aligning Compensation Strategy with HR Strategy and Business Strategy- New trends in compensation management – The 3- P compensation concept.

Unit-V

Designing Compensation System - Employee Benefits Management

Bases for Traditional Pay System and Modern Pay System – Establishing Pay Plans – Seniority and Longevity pay - Linking Merit Pay with Competitive Strategy-Incentive Pay-Person focus to Pay – Team Based Pay. Fringe Compensation - Legally required Benefits- Discretionary Benefits. International Compensation- Executive Compensation Packages

Text Books:

1. Michael Armstrong, "Performance Management", Kogan Page, 2010.
2. Robert L Cardy, "Performance Management", PHI, 2008 .
3. Joseph J.Martocchio, "Strategic Compensation", Pearson Ed Richard I, 3rd Ed., 2006.
4. Dr. Kanchan Bhatia, "Compensation Management", Himalaya Publishing House, 2009.

Suggested Readings:

1. T.V. Rao,"Performance Management & Appraisal System", Sage, 2008.

2. A.M. Sarma, "Performance Management systems", *HPH,2010.*
3. Handerson, "Compensation Management in a Knowledge Based World", 9th Ed., Pearson, 2007.
4. Milkovich & New Man, "Compensation", Tata McGraw *–Hill, New* Delhi, 2005.

16MB E104 (HR)

ORGANIZATIONAL DEVELOPMENT AND CHANGE MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To provide knowledge on Organization Development concepts and its evolution.
2. To educate the students about the different stages in the process of Organization Development.
3. To introduce the concept and provide knowledge on OD interventions and its types.
4. To discuss the practical approach of implementing OD interventions.
5. To explain the basics of change management and its process.
6. To provide knowledge on various change models and their importance in practice.

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

1. Solve a business problem from an organizational development perspective as an OD practitioner.
2. Involve, assist or lead the process of Organization Development.
3. implement the existing Organization Development interventions at their workplace.
4. Design and implement a new set of Organization Development interventions at their workplaces.
5. Successfully deal with change processes using tools like diagnostic models.
6. Apply change models and develop newer models in an organization for development.

Unit - I

Introduction

Definitions of OD-Growth and Relevance Of OD - A Short History of OD and its Evolution - Characteristics of OD-The Organization Development

Practitioner – Competencies of an Effective Organization Development Practitioner.

Unit- II

The Process of Organization Development

Entering and Contracting - Diagnosing Organizations - Diagnosing Groups and Jobs-Collecting and Analyzing Diagnostic Information - Feeding Back Diagnostic Information - Designing Interventions - Leading and Managing Change - Evaluating and Institutionalizing Organization Development Interventions.

Unit - III

OD Interventions

Human Process Interventions: Coaching and Training, Process Consultation,Third Party Intervention,Team Building, Organization Confrontation Meeting, Inter Group Relations, Large-Group Interventions. Technostructural Interventions: Structural Design, Downsizing, Reengineering, Parallel Structures, High Involvement Organizations, Total Quality Management, Work Design.HRM Interventions: Goal Setting, Performance Appraisal, Reward Systems, Career Planning and Development, Managing Workforce Diversity, Employee Wellness.Strategic Interventions: Integrated Strategic Change, Mergers And Acquisitions Integration, Alliances, Networks, Culture Change, Self Designing Organizations, Organization Learning and Knowledge Management.

Unit – IV

Change Management Concepts and Process

Defining Organizational Change, Forces for Change, Resistance, Responses and Reactions to Change, Overcoming Resistance to Change, Types of Changes, Diagnostic Models For Organizational Change – The Six Box Model, The 7s Framework, The Star Model, The Congruence Model, The Burke- Litwin Model, The Four Frame Model, Diagnosis By Image. Steps In Change Process.

Unit - V

Models of Change

Lewin's Change Model, Warfield 6-3-5 method - Rosemary Stewart's model-Tony Buzan's mind maps - Edward de Bono's six thinking hats - Johari window - Nadler and Tushman's congruence model - Scenario analysis - powerinterest matrix-Kotter's 8 - step change model - Pendlebury, Nadler, Kanter and Taffinder's planned change models. Dunphy Contingency Model of Change.

Text Books:

1. Thomas G. Cummings, Christopher G Worley, "Theory of Organization Development and Change", 9th Ed Cengage Learning, 2012.
2. Wendell French, Cicil, H. Bell, Jr., "Organization Development", 6 ed., Prentice Hall of India.
3. Kavita Singh, "Organisation Change and Development", Excel Publications, 2010.
4. Palmer,Dunford,Akin, "Managing Organizational Change", 7th edition, Tata Mc Grawhill, 2011.

Suggested Readings:

1. Reider Dale, "Organization & Development — Strategies, Structures, and Process", Sage Publications, New Delhi, 2006.
2. R. Sullivan, Gary Mclean, Jossey Bass. Brown, "Practising Organization Development", Pearson Education, 2006.
3. Nilanjan Sengupta, Mousumi S. Bhattacharya, R.N.Sengupta, "Managing Changes in Organizations", 2nd edition, PHI learning, 2009.
4. John Hayes, "The Theory and Practice of Change Management", 4th ed., Palgrave, 2014.

16MB E105 (M)

PRODUCT AND BRAND MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To provide an understanding of process, theories and models of New Product Development.
2. To understand the strategies for growth and product portfolio planning of multi business or multi product company.
3. To learn a professional approach to product development.
4. To understand the usage of market maps and its benefits.
5. To understand the importance of strong branding and branding decisions.
6. To create an awareness on how to generate brand equity and conduct a brand audit.

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

1. Understand new product development process and various theories and models of new product development to generate new products and translate them into new product concepts.
2. Design the portfolio strategies of multi business or multiproduct company.
3. Know how to develop the new products professionally.
4. To understand perceptual maps and various models of preference choice market maps.
5. Know the essential Branding strategies to conquer the market.
6. Understand and conduct the measurement of brand equity and brand performance.

Unit - I

Introduction

Product, Policy, objectives, Product Mix, Product line, Packaging, Product Modification and Deletion. New Product Development: Innovation and New Product Development (NPD) - Theories, Models, Generic Product Development Process.

Unit-II

New Product Introduction

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, Idea- Screening. Product Concept generation, concept selection, and Concept Testing, Product architecture, Design for manufacturing, Prototype Product.

Unit-III

Brand Management
Brand vs commodity, understanding brands, benefits of branding, brand attributes, Branding decisions, Brand awareness, Brand Image, Brand Personality, Brand positioning and repositioning . Brand Extension, Line extensions Brand Licensing, Franchising and global branding.

Unit-IV

Perceptual mapping - Preference choice models
Perceptual mapping, Preference – choice models, Wind Robertson Market Model, BRANDAID model and Defender model, DESIGNR, and PREFMAPS–flow charts and concepts. Innovation diffusion and adoption process.

Unit-V

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, Brand Audits, Tracking Valuation Managing Brand Equity- Brand worth, Reinforcement, Revitalization and Brand Crisis

Text Books:

1. Pessemier Edgar, "Product Management:, John Wiley & Sons, 1982 .
2. Ulrich K T, Anitha Goyal, "Product Design and Development", McGraw Hill, 2010 .
3. Chunnawala, "Compedium of Brand Management", Himalaya Publishing House, 2008.

Suggested Readings:

1. Dr. Anandan, "Product Management", Tata McGraw Hill, 2010.
2. Kavin Keller, "Strategic Brand Management", Pearson Education, 2008.
3. U C Mathur, "Product and Brand Management", Excel Books, New Delhi, 2009.

16MB E106 (M)

PROMOTION AND DISTRIBUTION MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To enlighten the students on the various facets of Marketing communications and Distribution Management.
2. To create an integrated marketing communications plan which includes promotional strategies and measures of effectiveness.
3. To understand the importance of personal selling process.and appreciate the role of media planning and strategies.
4. To communicate the unique marketing mixes and selling propositions for specific product offerings.
5. To provide an insight into the operation of marketing channels and logistics.
6. To understand the various facets of E-Business Framework.

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

1. Apply the integrated marketing communication and its application in the challenging marketing environment.
2. Choose the right media for effective marketing decision.
3. Splendid role of Personal selling and approach in the era of digital marketing.
4. Analyse the complexities of the Channel Management and make a right choice among the various channels of distribution.
5. Collect,process and analyse consumer information to make informed marketing decisions.
6. Understand various E-Business technologies.

Unit-I

Introduction

The nature of marketing communications. The integration of marketing communication, Integrated marketing communication planning process. Model of marketing communications decision process. Establishing objectives and budgeting for the promotional programme.

Unit – II

Developing Integrated Marketing Communications and Media plan

Creative strategy development. Process of execution of creative strategy: Appeals, execution styles and creative tactics. Media planning and Strategy: Developing Media Plans and Strategies and Implementation with Integrated Marketing Communication (IMC) perspective.

Unit – III

Promotion Mix

Role of personal selling in IMC programme. Integration of personal selling with other promotional tools.Personal selling process and approaches. Evaluating, motivating and controlling sales force effort. Sales Promotion - objectives, consumer and trade oriented sales promotion. Coordinating Sales promotions and advertisement. Support media – Elements of Support media and their role. Direct marketing, the internet and Interactive Marketing, publicity and public relations. Monitoring, evaluating and controlling promotion programme.

Unit – IV

Logistics and Channel Management

Logistics: Concept, Scope and Significance. Physical distribution of marketing channel system, Functions and Flows in Marketing Channels, Design of Distribution Channel , Concept, Characteristics, Role of channel decisions, components, Wholesaling, Retailing, Channel Planning,Channel Organisation, Channel Conflict, Co operation and Competition, Vertical marketing system, Horizontal Marketing system.

Unit-V

E-Business Frameworks

E-Selling, E - Buying, E-Procurement, E-Payments, E-Banking and E-CRM and E-tailing.

Text Books:

1. Shimp "Advertising and Promotion", Cengage Learning, 2007 .
2. Shah and D'souza, "Advertising & Promotion", Tata McGraw Hills, 2010.
3. Murthy CSV,"E-Commerce-Concepts,Models and strategies",Mumbai,Himalaya Publishing House, 2009.

Suggested Readings:

1. S.A. Chunnawalla, K.C.Sethia "Advertising", HPH, 2010.
2. Dr. S. Gupta, "Sales and Distribution Management",2nd ed., Excel Publications, 2010.
3. Bharath Bhasker, "Electronic commerce-Frameworks, Technologies and Applications", 3rd edition,New Delhi,Tata McGraw hill Publishing company Ltd., 2009.

16MB E107 (OM)

TOTAL QUALITY MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To make students analyse various perspectives on quality and various contributions of quality.
2. To explain the concepts and principles of Total Quality Management.
3. To provide an in-depth analysis on various quality control Tools.
4. To create awareness on quality control techniques.
5. To identify the framework for implementing TQM in service sectors.
6. To create awareness of quality awards, guidelines and the concept of six sigma.

Course Outcomes: After completion of the course, student will be able to:

1. Apply the management skills involved in quality assurance.
2. Develop the total quality management system in any sector.
3. Make use of the quality control tools and techniques.
4. Design and implement safety aspects of industrial plants.
5. Work in a quality framework that qualifies for quality awards.
6. Understand how six sigma systems are implemented in the industries.

Unit-I

Introduction

Introduction - Evolution of TQM- The concept and Principles of TQM-Inspection, SQC, QA and TQM, TQM Framework - Contributions of Deming, Juran and Crosby. Traditional Vs Modern perspectives on Quality Management- Benefits and Costs of TQM – Organising for TQM – System Approach- Teams for TQM – Self Managed Teams for TQM.

Unit – II

Tools of TQM

Measurement Tools: Check Sheets, Histograms, Run Charts, Scatter Diagrams, Cause and Effect Diagrams, Pareto's Chart, Process Capability Measurement. Analytical Tools: Process Mapping, The Five Why's, Overall Equipment Effectiveness. Improvement Tools and Techniques: Kaizen, JIT, Quality Circles, Forced field Analysis, Five S's. Control Tools: Gantt chart,Radar Chart, The PDCA cycle, Milestone Tracker Diagram and Earned Value Management.

Unit – III

Techniques of TQM

Quantitative techniques: Failure Mode Effect Analysis (FMEA), Statistical Quality Control (SQC): Control charts for average, range, fraction defectives, number of detects. Acceptance Sampling – Operating Characteristics Chart (OCC) - Quality Function Deployment (QFD), Design of Experiments (DOE), Quality by Design. Qualitative techniques: Benchmarking, Kanban. Taguchi methods: Quality loss function, Signal-to-Noise ratio: Nominal- the- best, Target-the-best, Smaller-the-best, Larger-the-best.

Unit –IV

TQM in the Service Sectors and Quality Accreditation

Implementation of TQM in service organization: Framework for improving service quality, Implementation of SERVQUAL in practice . Quality System Awards and Guidelines – ISO, Malcolm Baldrige National Quality Award (MBNQA), European Foundation for Quality Management (EFQM),Environmental Management Systems – ISO 14000 – Rajiv Gandhi International Quality Award instituted by Bureau of Indian Standards.

Unit – V

Six Sigma

The concept of Six Sigma, Objectives of Six Sigma, The frame-work of Six Sigma programme, Six Sigma Organization: roles and responsibilities, Six Sigma problem solving approach, Six Sigma Metrics: Cost of poor quality, Defects per million opportunities and First pass yield. Benefits and costs of Six Sigma.

Text Books:

1. Shridhara Bhat K, "Total Quality Management–Text and Cases", First Edition, Himalaya Publishing House, 2002.
2. Dale H. Besterfield, Carol Besterfield - Michna, Glen H Besterfield and Mary Besterfield-sacre, "Total Quality Management", 3rd Ed., PHI, 2006 .
3. Ron Basu, "Implementing Quality: A Practical Guide to Tools and Techniques", Thompson, 2006

Suggested Readings:

1. Howard S Gitlow, Alan J Oppenheim, Rosa Oppenheim and David M Levine, "Quality Management", 3rd Ed., Tata McGraw-Hill.
2. Poornima M Charantimath, "Total Quality Management", Pearson, 2003.
3. Mukherjee, P N, "Total Quality Management", PHI, 2007 .

16MB E108 (OM)

TECHNOLOGY MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To create awareness among the students about the range, scope, and complexity of technological innovation.
2. To explain the role of Technology Management in managing business operations.
3. To formulate technology strategies and link with business strategy.
4. To follow the steps in technology forecasting process.
5. To learn about issues in transfer of technology.
6. To develop an insight in technology assessment.

Course Outcomes: After completion of the course, student will be able to:

1. Apply knowledge of business concepts and various functions in an integrated manner.
2. Demonstrate knowledge about technology management.
3. Explain how to formulate technology strategies and link business strategies to them.
4. Illustrate steps in technology forecasting process.
5. Appreciate the issues in transfer of technology.
6. Evaluate and assess the strategies of technology investment.

Unit-I

Introduction

Definition, Role and Importance, Technology developments - Options and strategies, factors contributing to successful Technology, Technology change. Technology Life Cycle (TLC), Diffusion and Growth of Technology-Technology transformation, Technology alternatives, Technology Policy and Planning.

Unit-II

Technology Strategy

Meaning of Strategy. Formulation of Technology Strategy. Direction of strategy. Technology and the concept of Core competence integration. Linking Technology and Business Strategies. Creating the product – Technology – Business connection.

Unit-III

Technology Forecasting for Decision Making
The definition of Technology Forecasting, Forecasting and Technology innovation Chain, Forecasting System Inputs and Outputs, Classification of Forecasting Techniques and methods. Technology Audit.

Unit-IV

Technology Transfer
Dimensions and Routes of Technology transfer. Stages within the process of Technology transfer Modes of Technology transfer- Technology import in India, Government Initiatives. Benefits of Technology absorption.

Unit-V

Technology Assessment (TA)
Management of Technology Assessment. Strategic evaluation of Technology Investments. Organizational support System- Structural Imperatives of Technology Management, Building Organization Culture. The Organization as a Laboratory for Learning.

Text Books:

1. Tarek Khalil,"Management of Technology- The Key to Competitiveness and Wealth Creation", McGraw Hill, Boston, 2000.
2. V. K. Narayanan,"Managing Technology and Innovation for Competitive Advantage", Pearson Education, 2003.
3. P.N.Rastogi,"Management of Technology and Innovation", Sage Publications Inc, 1995.

Suggested Readings:

1. Norma Harrison and Danny Samson, "Technology Management", McGraw-Hill International, 2001.
2. Melissa A. Schilling, "Strategic Management of Technological Innovation", TMH, 2008.
3. Goel Cohen, "Technology Transfer", Sage Publication, 2004.

16MB E109 (SYS)

RELATIONAL DATABASE MANAGEMENT SYSTEM (RDBMS)

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

Course Objectives: The objectives of the course are to:

1. Understand the role of a database management system in an organization.
2. Study the physical and logical database designs, modeling, relational, hierarchical and network models.
3. Describe the concept of a database transaction and related database facilities.
4. Discuss advanced database topics such as distributed database systems and special database.
5. Understand and successfully apply logical database design principles, including E-R diagrams.
6. Construct simple and moderately advanced database queries using Structured Query Language (SQL).

Course Outcomes: After completion of this course, students will be able to:

1. Differentiate database systems from file systems by the features provided by database systems.
2. Define the features, classification and characteristics embodied in relational database systems.
3. Master sound design principles for logical design of databases, including the E R method.
4. Understand the basic issues related to transaction processing and concurrency control.
5. Master the basics of SQL and construct queries using SQL.
6. Master the basic concepts and appreciate the applications of database systems.

Unit- I

Database Concepts and Modeling

Introduction overview - Client/Server Technology: 3 Tier architecture, data modeling, hierarchical, network, object oriented. Introduction to distributed databases - Relational Data structure: tuple, attributes, set; relational algebra operators, entity relationship diagrams, design of E-R Schema. E-R Schema to tables.

Unit – II

Relational Languages and Relational Database

Functional dependence: normal forms, integrity constraints, domain, referential integrity, Codd's rules, elementary operations, set operations, aggregate functions, null values, nested sub queries, derived relations, views, joined relations, DDL, embedded SQL, QBE.

Unit- III

Transaction Processing

Transaction concepts: ACID Properties - Atomicity, Durability, Serializability, Isolation, transaction definition in SQL, Concurrency control, locking, deadlock handling, recovery systems.

Unit - IV:

Distributed and Special Database

Distributed data storage, network transparency, distributed query processing, commit protocols. Special Databases - spatial and geographical database, multimedia database, mobility and personal database.

Unit - V:

ORACLE

Introduction: SQL- characteristics, advantages, data types, SQL commands for data definition and data manipulation, views-procedures- indexing, PL/SQL. Forms design process, triggers.

LAB EXERCISES

- Creating Tables and Applying All Constraints
- Inserting Data into Tables
- Updating Tables
- Alias Table
- Deleting Data From Table
- Drop Table
- Working with All SQL Queries using functions (Number, string functions etc.)
- Working with sub queries
- Working with Joins
- Creating Views
- Creating Objects (i.e. Cluster, Synonyms, Indexes etc.)

Text Books:

1. Lee Chao. "Database Development and Management", 2010, Special Iodian Ed. Auerbach Publications.
2. Narayan S. Umanath & Richard W. Scamwell, "Data Modeling and Data Base Design",Thomson - India Edition, second edition.
3. Rob & Coronel, "Database Systems". Thomson, 1993.
4. Page, Jr. Special edition Using Oracle BIBi. Prentice Hall-India.

5. Abraham Shibershat.z, Henry F. Korth & S Sudershan- "Data Base System Concepts",McGraw Hill, 5^{th} edition.
6. Lemme & Colby. "Implementing and Managing Oracle Databases", Prentice Hall of India.
7. Hansen & Hansen, "Database Management & Design", Prentice Hall.

Suggested Readings:

1. Database Systems: A Practical Approach to Design, Implementation and Management (4th Edition) , Thomas M. Connolly, Carolyn E. Begg, Pearson Education Publication.
2. Information Modeling and Relational Databases: From Conceptual Analysis to Logical Design (The Morgan Kaufmann Series in Data Management Systems), Published by Morgan Kaufmann

SCHOOL OF MANAGEMENT STUDIES
CBIT
Hyderabad

16MB E110 (SYS)

E-BUSINESS

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

Course Objectives: The Objectives of the course are:

1. To provide in depth knowledge on information systems and its usefulness in business.
2. To throw light on the impact of the Internet and Internet technology on business electronic commerce and electronic business.
3. enable the students to understand concepts of e-commerce and its applications in e-business.
4. To educate students to identify the major management challenges To building and using information systems and learn how to find appropriate solutions to those challenges.
5. To Cultivate skills and experience in the development and implementation of information systems projects in e-business payments and security.
6. To understand the legal and privacy issues in the usage of different e-business concepts.

Course Outcomes: After completion of the course, student will be able to:

1. Understand the basic concepts and technologies used in the field of management by e-commerce.
2. Analyze the processes of developing and implementing information systems in business.
3. Demonstrate an understanding of the foundations and importance of E-commerce.
4. Analyze the impact of E-commerce on business models and strategy.
5. Be able to understand the concepts of e-business payments and security.
6. Discuss legal issues and privacy in the usage of e-business applications.

Unit–I

Introduction

E-business, E-commerce, Economic forces – advantages – myths – e-business models, design, develop and manage e-business, Web 2.0 and Social Networking, Mobile Commerce, S-commerce.

Unit–II

Technology Infrastructure

Internet and World Wide Web, internet protocols - FTP, intranet and extranet, information publishing technology- basics of web server hardware and software.

Unit- III

Business Applications

Consumer oriented e-business – e-tailing and models - Marketing on web – advertising, e-mail marketing, affiliated programs - e-CRM; online services, Business oriented e-business, egovernance, EDI on the internet, Delivery management system, Web Auctions, Virtual communities and Web portals – social media marketing

Unit- IV

E-Business Payments and Security

E-payments - Characteristics of payment of systems, protocols, e-cash, e-cheque and Micro payment systems- internet security – cryptography – security protocols – network security.

Unit- V

Legal and Privacy Issues

Legal, Ethics and privacy issues – Protection needs and methodology – consumer protection, cyber laws, contracts and warranties, Taxation and encryption policies.

Text books:

1. Harvey M.Deitel, Paul J.Deitel, Kate Steinbuhler, "e-business and e-commerce for managers", Pearson, 2011.
2. Efraim Turban, Jae K. Lee, David King, Ting Peng Liang, Deborrah Turban, "Electronic Commerce –A managerial perspective", Pearson Education Asia, 2010.
3. Parag Kulkarni, SunitaJahirabadkao, Pradeep Chande, "e business", Oxford University Press, 2012.

Suggested Readings:

1. Hentry Chan &el , "E-Commerce – fundamentals and Applications", Wiley India Pvt Ltd, 2007.
2. Gary P. Schneider, "Electronic commerce", Fourth annual edition, Thomson course technology, 2007.
3. Bharat Bhasker, "Electronic Commerce-Frame work technologies and Applications", 3rd Edition. Tata McGrawHill Publications, 2009.

16MB E111(F)

FINANCIAL RISK MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To make the students understand the types of risks and how to identify the risks in a given scenario.
2. To focus on how to measure the risks and plan to manage them in a practical scenario.
3. To equip the students with the forward contracts as risk management technique.
4. To discuss the concept of futures contract and use it as a risk management tool.
5. To make the students understand how to use swaps as a tool for managing the risk.
6. To enable the student to understand the concept of options contract as a risk management tool.

Course outcomes: After completion of the course, student will be able to:

1. Understand various forms of risk an organization faces.
2. Measure the various risk an organization faces.
3. Employ Forwards as a tool for managing the risks.
4. Apply Futures Contracts concept to manage the risk that an organization faces.
5. Use SWAPS as a technique to manage the risk.
6. Understand Option contracts as a best tool for managing various risks.

Unit – I

Introduction to Risk Management

The concept of Risk, 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, liquidity 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 -Forward contracts

A) The concept of Derivative and types of Derivatives. The role of Derivative securities to manage risk and to exploit opportunities to enhance returns.

B) Forward contracts: Definition, features and pay-off profile of Forward contract. Valuation of forward contracts. Forward Contracts to manage Commodity price risk, Interest rate risk and exchange rate risk. Limitations of Forward contract.

Unit – III

Futures contracts

Futures contracts: Definition. Clearing house, margin requirements, marking to the market. Basis and convergence of future price to spot price. Valuation of Futures contract. Differences between forward contracts and futures contracts. Risk management with Futures contracts – the hedge ratio and the portfolio approach to a risk – minimizing hedge.

Unit – IV

SWAPS Contracts

Definition, types of swaps, Interest rate Swaps: Mechanics of Interest rate swaps, Valuation of interest rate Swaps. Pricing of Interest rate swaps at origination and valuing of Interest rate swaps after origination.

Currency Swaps: Types of Currency Swaps. Valuation of currency swaps. Pricing of currency swap at origination and valuing of currency swap after origination.

Unit – V

Options Contracts:

Definition, Types of options: call option, put option, American option and European option. Options in the money, at the money and out of the money. Option premium, intrinsic value and time value of options. Pricing of call and put options at expiration and before expiration. Options on stock indices and currencies. The Binominal Option Pricing Model (BOPM): assumptions - single and two period models. The Black and Scholes Option Pricing Model (BSOPM): assumptions.

Text Books:

1. John C. Hull &SankarshanBasu, "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. David. A. Dubofsky & Thomas. W. Miller, Jr., "Derivatives Valuation and Risk Management", 1st edition Oxford University Press, 2002.

Suggested Readings:

1. R.Madhumathi,M. Ranganatham, " Derivatives and Risk Management", Pearson Education, 2012 .
2. Paul Hopkins, Kogan Page, "Fundamentals of Risk Management", 4th Ed., Institute of Risk Management, 2017 .
3. Jean-Philippe Bouchaud and Mark Potters, "Theory of Financial Risk and Derivative Pricing", 2nd Ed. Cambridge press, 2009.

16MB E112 (F)

BANKING AND INSURANCE

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

Course Objectives: The Objectives of the course are:

1. To provide conceptual and practical understanding of Banking Industry and Insurance.
2. To make students proficient in management of various Lending functions of banking.
3. To provide latest trends and regulations in banking arena.
4. To train and equip the students with the dextry of skills with which modern banking runs through Innovations.
5. To provide an in-depth knowledge in insurance as a Risk Management Technique.
6. To educate the students with various types of Life Insurance contracts, Health and General insurance.

Course Outcomes: After completion of the course, student will be able to:

1. Understand managerial issues in the banking and Insurance industry.
2. Develop a clear understanding and knowledge about the Lending functioning of bank.
3. Better understanding of various activities of banks including Regulation of Bank Capital.
4. Understands of banking system with new innovative products and services.
5. Enrich with knowledge of insurance and develop their specialties in the field of Insurance.
6. Understand the types of Life Insurance contracts, Health and General insurance.

Unit I

Introduction

Banking: Definition, Meaning, Kinds of Banking, Role of Banks in the development of economy, Evolution of Banking in India – origin, nationalization, reforms, RBI : Origin and growth – Functions , Analyzing banks' financial statements: CAMELS, Ratings, Key Performance indicators.

Insurance: Definition, terminology of insurance: Bound, Insurer, Insured, Premium, Policy, Exposure to loss, Insurance as a Risk Management Tool, classification of Insurance: Life, Marine, Fire, Aviation, Motor; Principles of Insurance, Role of Insurance in Financial System.

Unit –II

Sources and Uses of Bank Funds

Sources of Bank Funds, Deposits, Other sources and Banc-assurance. Features of Bank Credit, types of lending, steps to be followed in the assessment of credit worthiness of a prospective borrower, the 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, NPA's:- The gross and net concept of NPA, causes, implications and recovery of NPA's.

Unit – III

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.

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, Green Banking, Mergers of Banks, Global Banking Activities.

Unit – IV

Regulatory Framework and Life Insurance

Functions of Insurers: Production, Underwriting, Rate Making, Managing Claims and Losses, Types of Insurers, An overview of IRDA.

The concept of Life Insurance, types, Tax treatment, Life Insurance Products Participating and Non participating Life Insurance, Classification of Life Insurance.

Unit – V

General Insurance and Reinsurance

General insurance – Concept, classification main players, types, Reinsurance: the concept, uses and advantages. Marketing channels: Agents and brokers professionalism, remuneration, responsibilities, classification, criteria for appointment and capital adequacy norms for broker.

Text Books:

1. Padmalatha Suresh & Justin Paul, "Management of Banking & Financial Services", 3rd Edition., Pearson Education, 2014.
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.

Suggested Readings:

1. Vasant Desai, "Banks & Institutional Management", 2nd Edition, Himalaya Publishing House, 2010.
2. Emmett J. Vaughan & Therese M. Vaughan, "Fundamentals of Risk & Insurance", 11th Edition, Wiley, India, 2014 .
3. Mark. S.Dorfman, David A. Cather, "Introduction to Risk Management & Insurance", 10th Edition, Prentice - Hall of India Private Limited, 2012.

16MB E113 (HR)

INDUSTRIAL RELATIONS AND LABOUR LAWS

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

Course Objectives: The Objectives of the course are:

1. To develop an understanding of the basics of industrial relations and approaches.
2. To make students understand the concepts, importance and recognition of trade unions,recognition and standing orders .
3. To discuss the importance of labour laws, labour administration and labour policy.
4. To familiarize the students with various parties involved in labour administration.
5. To introduce various Acts related to employee benefits.
6. To make the students aware about the various Acts available related to wages.

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. Effectively use the dynamics of trade unions and their recognition for successful negotiations.
3. Suggest and involve in the process of labour administration and labour policy.
4. Deal properly with various parties involved in labour administration.
5. Implement and design various employee benefits both legally required and discretionary.
6. Involve in and Implement the provisions related to various wage acts at work places.

Unit-I

Industrial Relations Perspectives

Conceptual framework and approaches to Industrial Relations – Influence of Emerging socio Economic scenario on growth of Industrial relations in India-Factors influencing Industrial Relations in India - Differences in perspectives – Industrial relations and Employee relations. 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 Labourlaws, 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 - 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. P.N.Singh and Neerajkumar, "Employee Relations Management", Pearson Education, New Delhi, 2011 .

2. Joseph J.Mortocchio, "Employee Benefits", Tata McGraw Hill, New Delhi, 2010.
3. S.C.Srivatsava, "Industrial Relations and Labour Laws", Vikas Publishing House, New Delhi, 2008 .

Suggested Readings:

1. C.S.VenkatRathnam,"Industrial Relations",Oxford University Press - New Delhi.
2. R.SivarathnaMohan, "Industrial Relations and Labour Welfare", PHI Learning Pvt.Ltd., 2010.
3. P.K.Padhi,"Labour and Industrial Laws", PHI Learning Pvt. Ltd., 2009.

16MB E114 (HR)

TALENT AND KNOWLEDGE MANAGEMENT

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

Course Objectives: The Objectives of the course are to :

1. Understand the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
2. Appreciate the role and use of knowledge in organizations and institutions, and the typical obstacles that Knowledg Management (KM) aims to overcome.
3. Know the core concepts, methods, techniques, and tools for computer support of knowledge management.
4. Understand how to apply and integrate appropriate components and functions of various knowledge management systems.
5. Be prepared for further study in knowledge generation, engineering, and transfer, and in the representation, organization, and exchange of knowledge.
6. Critically evaluate current trends in knowledge management and their manifestation in business and industry.

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

1. Understand the importance of talent management and how to apply the theoretical approaches in the analysis of talent in the organization.
2. Understand the essential elements of a typical Talent Management System (TMS) and can learn about best TMSs.
3. Define KM, learning organizations, intellectual capital and related terminologies in clear terms and understand the role of knowledge management in organizations.
4. Identify and select tools and techniques of KM for the stages of creation, acquisition, transfer and management of knowledge.
5. Analyze and evaluate tangible and intangible knowledge assets and understand current KM issues and initiatives.
6. Evaluate the impact of technology including telecommunications, networks, and Internet/intranet role in managing knowledge.

Unit – I

Introduction

Talent management: Definition, Meaning, Importance, Scope, Key Processes, Implementing a Talent Management strategy, Key elements of TM strategy, Tools for Managing Talent.

Knowledge Management: Introduction, History, Concepts, Definition, Nature, Alternative views of knowledge, Types of knowledge, Location of knowledge, Rise of the knowledge worker, Characteristics of Individual Knowledge workers, Major Categories of KM Roles, The KM Profession, The Ethics of KM, Future Challenges for KM.

Unit – II

Talent Management

Designing and building a talent reservoir, Segmenting the Talent Reservoir, Talent Management Grid, Creating a talent management system, Institutional strategies for dealing with talent management, Importance of learning and development in TM.

Unit – III

Competency for Talent Management

Competency- Meaning- Characteristics- Types –Steps in developing valid competency model- Importance of competency in Talent Management- Talent management information systems- Developing a talent management information strategy- Bersin and Associates TM Model- Role of leaders in talent management- Global talent management.

Unit – IV

Approaches and Framework of Knowledge Management

Knowledge management framework of Hansen– Earl's seven schools of knowledge management– Alvesson and Karreman's knowledge management approaches- Features of knowledge intensive firm- Key processes in knowledge intensive firms- From Physical Assets to Knowledge Assets - The Knowledge Creation Process- Knowledge management solutions, mechanisms and systems. Knowledge management infrastructure. Issues and problems related to KM.

Unit – V

Knowledge management and Organisational Performance

Knowledge Application at Group and Organizational Levels - Knowledge Reuse - Knowledge Sharing Communities- Obstacles to Knowledge Sharing-Organizational impacts of knowledge management - on people, processes, products and organizational performance. Knowledge management assessment of an organization – Importance, Types and Timing. Knowledge discovery systems.

Text Books:

1. Ed by Lance A. Berger and Dorothy R Berger. "The Talent Management Handbook", Tata McGraw Hill edition, 2011.
2. KimizDalkir, "Knowledge Management in Theory and Practice", Butterworth – Heinemann, 2005.
3. Donald Hislop, "Knowledge Management in Organizations", Third edition, Oxford University Press, 2013.
4. Irma Becerra-Fernandez, Avelino Gonzalez and Rajiv Sabherwal "Knowledge Management", Pearson Education Inc., 2009.

Suggested Readings:

1. Ed by Larry Israelite, "Talent Management", ASTD Press, 2009.
2. Sajjad M Jasmuddin, "Knowledge Management", 1st Ed, Cambridge, 2009.
3. Stuart Barnes, "Knowledge Management Systems", Cengage Learning, 2001.

16MB E115 (M)

CONSUMER BEHAVIOUR

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

Course Objectives: The Objectives of the course are:

1. To give perspective of consumers and their buying behavior patterns.
2. To help the students to acquire knowledge to design market research studies for the mutual benefit of consumers and the organisations.
3. To address the importance of subculture and global consumer culture as marketing opportunities.
4. To make them aware of the consumer learning principles and their Marketing implications.
5. To enable them to understand the intricacies of consumer decision making process.
6. To create an awareness on principal factors that influence consumers as individuals and decision makers with an application to the buying decision process.

Course Outcomes: After completion of the course, student will be able to:

1. Apply theories of consumer behavior to the formulation of effective marketing strategy for better consumption behavior.
2. Recognise market trends based on current research related to consumer behavior.
3. Analyze the challenges that might influence the formulation of effective Marketing Strategies from a consumer behavior perspective.
4. Understand that the impact of socio cultural settings on the consumption behaviour.
5. Identify the dynamics of human behaviour and the basic factors that influence the consumers decision process.
6. Demonstrate how concepts may be applied to marketing strategy.

Unit-I

Introduction

Introduction, Definition, Evolution, Contemporary Dimensions of Consumer Behaviour, CB Research Process, Buyers and Users, Development of Marketing Concept, Consumer Behaviour and its Applications in Marketing, concepts of motivation and personality, perception and their marketing implications.

Unit-II

Learning Principles and Marketing Implications

Concept of learning, important aspects of learning Process, Concepts of conditioning, Important aspects of information processing theory; encoding and information retention, Retrieval of Information, Split – brain theory.

Unit-III

Environmental Influences on Consumer Behaviour

Social and cultural settings- Culture, subculture and Cross cultural Marketing practices. Family life cycle-1,2,3 and Reference groups- Personality- Theories, Life style Influences- AIO and VALS Framework. Ethno Centrism.

Unit-IV

Consumer Decision Making Process

Meaning of Decision Making, Different views, Buying Motives, Types of decision making process in buying, Consumer Information processing- Information search, Evaluation of alternatives, Purchasing Process, Post purchase behaviour, Consumer action and disposable of products.

Unit-V

Models of Consumer Behaviour

Models of Consumer Decision making Process, contemporary models, Generic Model of Consumer Behaviour, Howard Sheth Model, Engel Blackwell and Rao-Lilien model. Role of Consumerism.

Text Books:

1. Black-well, R.Miniard PW and Engel, "Consumer Behaviour", Thompson learning, 2010 .
2. David L. Loudon and Albert.J.Della Bitta, IVth Edition,"Consumer Behaviour",TMH, 2008.
3. Schiffman and Kannik "Consumer Behaviour" Pearson Edition, 2014/PHI, 2004.

Suggested Readings

1. Suja R .Nair, "Consumer Behaviour in Indian Perspective", HPH, 2013 .
2. Sheth and Mittal, "Consumer Behaviour", Thompson learning, 2015 .
3. MichealR.Solomon,"Consumer Behaviour", 7/e, PH, 2016.

16MB E116 (M)

SERVICES AND RETAIL MARKETING

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

Course Objectives: The Objectives of the course are:

1. To familiarize students with characteristics of services, their implications on service delivery and retail marketing concepts.
2. To make the students understand the concepts of services and retail industry.
3. To provide insight into the marketing mix for services and service quality.
4. To educate students on strategies to deal with characteristics of services and concept of services marketing traingle.
5. To create awareness on retail formats and theories.
6. To provide the issues relating to merchandise management and 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 services depending upon sector.
4. Equip with strategies to succeed in dealing with characteristics of services and relationship among the stakeholders.
5. Develop retail formats considering the need of the customers.
6. Analyse 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

Concepts, Scope of Services.Goods - Services Continuum. 4 I s of Services Goods and Services. Categorization. Industrial Services.

Retailing - Meaning, Types, significance of retail industry, Emergence of Organized Retailing, Indian vs. Global Scenario.

Unit – II

Service marketing Mix

Product, Pricing, Place, Promotion, People, Physical evidence and Process-Dimensions of Service Quality. Understanding Service 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

Retailing

Retail formats and Theories – Theories of retail development, concept of retail life cycle, classification of retail stores, 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.

Unit - V

Merchandise Management

Sources of Merchandise, Category Management, Store Layout, Design and Visual Merchandising, Retailing Strategy and Customer Service. CRM in retailing. E-tailing-Issues and Challenges

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. AJLamba, "The Art of Retailing", TMH, 2009.
4. Levy and Weitz, "Retailing", TMH, 2009.

Suggested Readings:

1. Lovelock, Chatterjee, "Services Marketing People, Technology Strategy", Pearson Ed., 2011.
2. VinnieJauhari, KirtiDutta, "Services", Oxford University Press, New Delhi, 2009 .
3. David Gilbert, "Retail Marketing Management", 2nd edition, Pearson Education, 2003.
4. Patrick M.Dunne, Robert F.Lusch, and James R.Carver, Retailing, Cengage Learning, 2014 .

16MB E117 (OM)

SERVICE OPERATIONS MANAGEMENT

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

Course Objectives: The Objectives of the course are:

1. To analyse the role of service sector in an economy and the service sector of an organisation.
2. To observe how to win customers through service strategies.
3. To develop an insight into design and development of new services.
4. To design services supply chain.
5. To learn about capacity management issues.
6. To learn about risk and security issue in financial services sector and the role of technology in handling these issues.

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

1. Demonstrate knowledge about the role of services sector in an economy and service strategy of an organization.
2. Use and explain the meaning of winning the customers through service strategies.
3. Apply the basic principle to design and development of new services.
4. Evaluate the design of given services supply chain.
5. Illustrate the cases where capacity management issues are well handled.
6. Identify the technology related issues in handling risk and security in financial services sector.

Unit-I

Introduction

Understanding Services Economy- Global trends in Services Sector; Changing paradigms in Competitiveness of services; Services – Manufacturing Continuum. Role of services in manufacturing firms.

Unit-II

Service Strategy

Developing an overall vision for the service system, Developing a service strategy, Service Positioning and Implications for Service Delivery Design, Service Enhancement using Internet, Pricing strategies in Services, Performance issues in service systems.

Unit-III

Design of Service Delivery Design

Capacity issues in service systems- Notion of capacity, Capacity build up strategies. Capacity Vs System Performance. Queueing Theory Applications in Service Systems. Simulation as a tool for design of services- Use of simulation software for modeling. Nature of design issues addressed using simulation. Simulation Applications in Service System Design. The services supply chain

Unit-IV

Application Domain in Services

Services Management in IT/ITES Sectors- Off-shoring / Outsourcing – Strategic dimension and Competitive advantage. Services Management in IT/ITES Sectors- Capacity Management Issues. Models for Manpower Planning.

Unit-V

Services Management in Financial Services

Risk and Security issues in Financial Services Sector: Role of technology, Technology Transfer.

Text Books:

1. B. Fitzsimmons, James A., and Mona J. Fitzsimmons, "Service Management: Operations, Strategy, and Information Technology", 7thEd., Tata McGraw-Hill Education Pvt. Ltd., 2014.
2. Robert Johnston, Graham Clark, MichealShulver, Service Operations Management- Improving Service Delivery, 4th Edition, Pearson, 2014.
3. Richard Metters, Kathryn King - Metters, Madeleine Pullman, Steve Walton Successful Service Operations Management, 2nd edition, South-Western/Cengage Learning, 2012.

Suggested Readings:

1. Bill Hollins and Sadie Shinkins, Managing Service Operations, 1st edition, Sage, 2006.
2. J.Nevan Wright and Peter Race, the management of service operations, 2nd edition, Thomson, 2004.
3. CengizHaksever, Barry Render, Roberta S. Russell, Rebert G. Murdick, Service Management and Operations, Pearson Education, 2000.

16MB E118 (OM/Systems)

ENTERPRISE RESOURCE PLANNING

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

Course Objectives: The objectives of the course are to:

1. familiarize the students with the business process of an enterprise.
2. provide an insight into the evolution, benefits and risks of Enterprise Resource Planning (ERP) systems.
3. acquaint students about the various functional modules of ERP.
4. grasp the activities related to the ERP Implementation lifecycle.
5. analyze the key success and failure factors of ERP implementation.
6. understand the emerging trends in ERP development.

Course Outcomes: After completion of this course, students will be able to:

1. acquire in-depth knowledge of ERP as a prime Application software product.
2. comprehend core and extended modules of ERP.
3. demonstrate detailed knowledge of ERP Implementation cycle.
4. understand the usefulness of maintenance post ERP implementation.
5. understand concepts of reengineering and how they relate to ERP implementation.
6. gain knowledge on the future trends in ERP.

Unit- I

Introduction

Enterprise Systems -An overview, Need, Evolution, Benefits & Risks, Issues in Planning, design and implementation of cross functional integrated ERP Systems.

Unit - II

ERP Solutions and Functional Modules

ERP software solutions – Overview, Business Process Reengineering (BPR), Business Process Management (BPM); ERP Functional Modules: Finance, Manufacturing, Human Resource, Supply Chain, Marketing and Customer Relationship Management.

Unit- III

ERP Implementation
Planning, evaluation and selection of ERP systems, Implementation life cycle, ERP implementation, Methodology and Frame work- Training – Data Migration. People, Organization in implementation – Consultants, Vendors and Employees.

Unit - IV

Emerging trends in ERP
Extended ERP systems and ERP add-ons - CRM, SCM, Business analytics - Future trends in ERP systems-web enabled, Wireless technologies

Unit - V

Post ERP Implementation
Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation. Feedback process.

Text Books:

1. Alexis Leon, Enterprise Resource Planning, Third edition, Tata McGraw-Hill, 2014.
2. Concepts in Enterprise resource planning, Fourth edition, Course Technology Cengage Learning, 2013.
3. Alexis Leon, ERP demystified, Third Edition Tata McGraw-Hill, 2014.

Suggested Readingss:

1. Sinha P. Magal and Jeffery Word, Essentials of Business Process and Information System, Wiley India, 2012.
2. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008.

SCHOOL OF MANAGEMENT STUDIES
CBIT
Hyderabad

16MB E119 (SYS)

CLOUD COMPUTING AND INTERNET OF THINGS

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

Course Objectives: The Objectives of the course are to:

1. To upgrade the students with the trending software technologies.
2. To understand basics of cloud computing for business management.
3. To analyze the implementation and usage and control of cloud computing in business.
4. To explain the applications of cloud services.
5. To understand the basics on Internet of things.
6. To analyze the applications of Internet of things in various streams.

Course Outcomes: After completion of the course, student will be able to:

1. To gain Knowledge of various applications on cloud for efficient business management.
2. To choose the appropriate technologies, algorithms, and approaches for the related issues.
3. To articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
4. To explain the core issues of internet of things and its technologies.
5. To identify the usage of IOT in different streams.
6. To provide the appropriate cloud computing and internet of things solutions and recommendations according to the applications used.

UNIT- I

Introduction

Introduction to Cloud Computing: Evolution - Cloud Computing, Hardware, Internet and Software, Virtualization, Web Services on Cloud. Introduction to Internet of things: Definitions and Characteristics of IOT, Physical Design of IOT-Things in IOT.

UNIT –II

Implementation and Control

Privacy and its relation to Cloud-based Information Systems, Security in the Cloud, Common Standards in the Cloud, End-User Access to the Cloud Computing, legal and ethical dimensions.

UNIT- III

Applications of Cloud Services

Applications – Online Planning and Task Management – Event Management – CRM- Cloud service development tools - word processing, databases, storing and file sharing on cloud.

UNIT-IV

Internet of Things (IOT)

IOT Protocols, IOT Communication Models, IOT Enabling Technologies - Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems

Unit-V

Applications of IOT

Domain Specific IOTs: Various types of IOT Applications in Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Life Style-Wearable Electronics. Case Study on IOT System for Weather Monitoring.

Text Books:

1. John W. Rittinghouse and James F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, Taylor & Francis Group, Boca Raton London New York, 2010.
2. Kumar Saurahb, Cloud Computing – Insights into new era infrastructure, Wiley India, 2nd Edition, 2012.
3. ArshdeepBahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.

Suggested Readings:

1. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, 2009.
2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.
3. Alfredo Mendoza, "Utility Computing Technologies, Standards, and Strategies", Artech House INC, 2007.
4. Bunker and Darren Thomson, "Delivering Utility Computing", John Wiley & Sons Ltd., 2006.
5. George Reese, "Cloud Application Architectures", O'reilly Publications, 2009.

16MB E120

ORGANIZATIONAL BEHAVIOUR

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

Couse Objectives: The objectives of the course are to:

1. define basic organizational behaviour principles and analyse how these influences behaviour in the workplace.
2. analyse the influence of perceptions and personality on individual human behaviour in the workplace.
3. provide knowledge on different organisational structures; and concepts of culture, climate and organisational development.
4. discuss the theories of Motivation and Leadership.
5. describe the interpersonal and their intrapersonal reactions within the context of the group and also demonstrate effective communication and decision making skills in small group settings.
6. familiarize the students with the basic understanding of individual behaviour and explore issues of power, politics, conflict and negotiation.

Course Outomes: After completion of this course, students will be able to:

1. enable the students to practically implement the Organisational behaviour principles and practice in real time situations.
2. analyse the behaviour, perception, and personality of individuals and groups in organisations in terms of the key factors that influence organisational behaviour.
3. to examine various organisational designs and explain concepts of organizational culture, climate and organisational development.
4. acquire knowledge in applying motivational theories to resolve problems of employees and identify various leadership styles and the role of leaders in decision making process.
5. to explain group dynamics and skils required for working in groups and identify the processes used in developing communication and resolving conflicts.
6. analyze organizational behavioural issues in the context of power, politics, conflict and negotiation issues.

Unit – I

Introduction

Organizational behavior – Nature and levels of organizational behavior – Individuals in organization – Individual differences – Personality and Ability – The Big 5 Model of personality – Organizationally relevant personality traits. The nature of perception – characteristics of the perceiver, target and situation – perceptual problems.

Unit – II

Organization Structure
Organizational Designs and Structures – Traditional and Contemporary organizational designs. Organizational culture and ethical behavior – factors shaping organizational culture– creating an ethical culture.

Unit – III

Motivation and Leadership
Motivation–early and contemporary theories of motivation. Leadership – early and contemporary approaches to leadership.

Unit – IV

Group Dynamics
Groups and group development – turning groups into effective teams. Managing change – process, types and challenges. Communicating effectively in organizations – communication process–barriers to communication–overcoming barriers to communication–persuasive communication–communication in crisis situations.

Unit – V

Power, Politics, Conflict and Negotiations
Power, Politics, Conflict and Negotiations – Sources of individual, functional and divisional Power. Organizational politics. Conflict – causes and consequences – Pondy's model of organizational conflict – conflict resolution strategies.

Text Books:

1. Jennifer George and Gareth Jones "Understanding and Managing Organizational Behavior", Pearson Education Inc., 2012.
2. Jon L Pierce and Donald G. Gardner, "Management and Organizational behavior", Cengage Learning India (P) Limited, 2001.
3. Richard Pettinger, "Organizational Behaviour", Routledge, 2010.

Suggested Readings:

1. Stephen P. Robbins, Jennifer George and Gareth Jones, "Management and Organizational Behaviour", Pearson Education Inc., 2009.
2. K. Aswathappa, "Organizational behavior", Himalaya Publishing House, 2013.
3. John Schermerhorn, Jr., James G. Hunt and Richard N. Osborn, "Organizational Behaviour", 10th edition, Wiley India Edition, 2009.

16MT C01

ENGINEERING MATHEMATICS – I

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

Course Objectives:
1. To solve Linear System of Equations using Matrix Methods
2. To Know the Partial Derivatives and use them to interpret the way a function of two variable behaves
3. To analyse the Shape of the Graph of a given Curve
4. To Evaluate Double and Triple integrals of various functions and their significance
5. Formulate and solve the Differential Equations of First Order
6. To know the methods to solve real life problems.

Course outcomes: On the successful completion of this course student shall be able to
1. Solve system of linear equations and identify the Eigen values and Eigen vector in engineering problems
2. Expand and find extreme values of functions of two variables
3. Trace and interpret curve behavior in physical systems
4. Find the areas, volumes and surface of solids revolution
5. Use-differential equations to model engineering phenomena such as circuit theory, networks
6. An ability to solve the problems and interpret it in geometrical approach

UNIT- I
Linear Algebra: Review of Rank & Consistency, Eigen values, Eigen vectors- properties (without proofs). Cayley- Hamilton Theorem (statement only) inverse and powers of a Matrix by Cayley-Hamilton Theorem. Reduction of Quadratic form to Canonical form by linear transformation, rank, positive, negative, definite, semi-definite, index and signature

UNIT- II
Functions of several variables: Partial differentiations, Homogenous function, Euler's theorem, Implicit functions, Jacobins, Taylor"s series in one and two variables, Maxima and Minima for function of two variables with and without constraints

UNIT- III
Differential Calculus: Curvature and Radius of curvature centre of curvature, circle of curvature. Evolutes, involutes and Envelopes, Curve tracing-Cartesian, polar and parametric curves

UNIT- IV
Multiple Integrals: Double Integrals, Triple Integrals, Change of order of Integration, Applications of integration, rectification, areas, volumes and surfaces of solids of revolution in Cartesian coordinates, Centre of Gravity, PAPPUS theorem.

UNIT- V
First order differential equations and its application: Exact differential equations, Orthogonal trajectory's, Electrical circuits, Newtons law of cooling

Text Books:

1. Ervin Kreyszig "Advanced Engineering " 10 Edition, john wiley & sons -publishers
2. A R.K.Jain&S.R.K.Iyenger "Advanced Engineering Mathematics" , 3rd edition, Narosa Publications
3. AlenJaffery "Mathematics for Engineers and Scientists", 6th edition : CRC press, Taylor & Francis Group.(Elsevier),2013

Suggested Reading:

1. Kanti.B.Datta "Mathematical Methods of science and engineering", Aided with MATLAB, .Cengage Learning India Pvt. Ltd, Pratapgang ,New Delhi
2. B.S.Grewal "Higher Engineering Mathematics" , Khanna Publishers
3. William E.Boyce /Richard C.Dip "Elementary differential equations" , 9th Edition

I/c HEAD
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16CY C01

ENGINEERING CHEMISTRY

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives

The syllabus has sought to fulfill the objective of making the student of engineering and technology realize that chemistry is the real base of his profession and that therefore he must have a good understanding of chemistry before he can use it in his profession.

" the study of chemistry is profitable not only in as much as it promotes the material interest of mankind ,but also because it furnishes us with insight into the wonders of creation , which immediately surround us and with which our existence, life and development, are most closely connected." Justus Von Leibig (German Chemist)

The various units of the syllabus is so designed to fulfill the following objectives.

1. This syllabus helps at providing the necessary introduction of the chemical principles involved and devices in a comprehensive manner understandable to the students aspiring to become practicing engineers.
2. The aim of framing the syllabus is to impart intensive and extensive knowledge of the subject so that students can understand the role of chemistry in the field of engineering.
3. Thermodynamics and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. Fuels have been taught with a view to give awareness as to materials which can be used as sources of energy
5. To understand importance of analytical instrumentation for different chemical analysis.

Course Outcome

1. This syllabus gives necessary theoretical aspects required for understanding intricacies of the subject and also gives sufficient exposure to the chemistry aspects in different disciplines of engineering
2. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.
3. This syllabus imparts a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

UNIT – I

Chemical Thermodynamics : Introduction and definition of the terms, the concept of reversible and irreversible processes, Work done in isothermal and adiabatic processes, Success and limitations of First law of thermodynamics, need for second law of thermodynamics, statements of second law of thermodynamics, Carnot cycle, heat engine and its efficiency, Carnot theorem, concept of Entropy - Entropy changes in reversible and irreversible processes, physical significance of entropy criteria of spontaneity in terms of entropy and Gibb's free energy function , Gibb's-Helmholtz equation and applications, Numericals.

UNIT – II

Phase rule & Chemical Equilibria

Phase rule : Statement , definition of the terms - phases, components , degrees of freedom with examples, Phase diagram - one component system (water system), two component system (siver-lead system) , desilverisation of lead.

Chemical Equilibria - Homogenous and Heterogenous Equilibria - applications

UNIT – III

Fuels: Classification, requirements of a good fuel, calorific value, types of calorific value, calculation of CV using Dulong's formula, Combustion - calculation of air quantities by weight and volume, Numericals.

Solid fuels: coal - analysis of coal – proximate and ultimate analysis - importance.

Liquid fuels - crude oil - fractional distillation, cracking - Fixed bed catalytic cracking, knocking, antiknocking agents (TEL, MTBE), octane number, cetane number, unleaded petrol.

Gaseous fuels - LPG, CNG - composition and uses

UNIT – IV

Electrochemistry Introduction, construction of electrochemical cell, sign convention, cell notation, cell emf, SOP and SRP, electrochemical series and its applications, Nernst equation and applications, Types of Electrodes - Standard Hydrogen Electrode, Saturated Calomel Electrode, Quinhydrone electrode and Ion selective electrode (Glass electrode), construction, Numericals

UNIT –V

Instrumental Techniques in Chemical Analysis: Principle, method and applications of Conductometry (acid-base titration), Potentiometry (acid-base, redox titration), pH- metry (acid – base titration), Colorimetry (Beer Lambert's law)

Green Chemistry - outlines and Principles

Text Books:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Pub, Co., New Delhi (2002)
2. Puri & Sharma, "Principles of Physical Chemistry
3. S.S.Dara & S.S.Umare, "Engineering Chemistry", S.Chand company
4. J.C. Kuriacase & J. Rajaram, "Chemistry in engineering and Technology", Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
5. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
6. P.R.Vijayasarathi, "Engineering Chemistry" PHI Learning Private Limited, New Delhi (2011)

Suggested Reading:

1. Physical chemistry by P.W.Atkin (ELBS OXFORD PRESS)
2. Physical chemistry by W.J.Moore (Orient Longman)
3. Physical Chemistry by Glasstone
4. Physical Chemistry by T.Engel & Philip Reid, Pearson Publication.
5. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd.,Meerut (2001).

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16PY C02

APPLIED PHYSICS

Instruction	2L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	20 Marks
Credits	2

Course Objectives: The objectives of the course is to make the student
1. Learn the concepts of modern physics
2. Gain knowledge of wave mechanics and statistical mechanics
3. Know the different kinds of materials and their characterization techniques

Course Outcomes: At the end of the course, the student will be able to
1. Understand the advances in laser physics, holography, optical fibers and apply them in engineering & technology
2. Explain the importance of wave mechanics and band theory of solids
3. Analyze and apply distributions of statistical mechanics for problem solving
4. Identify the materials with semiconducting and superconducting properties for engineering applications
5. Understand the role of novel materials and their characterization techniques in engineering and technology

UNIT – I

Lasers &Holography: Characteristics of lasers – Spontaneous & stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – He-Ne laser – Semiconductor laser – Applications. Basic principle of Holography – Recording & Reconstruction of hologram – Applications

Optical Fibers: Principle and Construction – Propagation of light through an optical fibre – Acceptance angle – Numerical aperture – Pulse dispersion – Classification of optical fibers: Single mode & Multi mode and Step-index & Graded-index optical fibers – Double crucible method – Applications.

UNIT – II

Wave Mechanics: Schrödinger time independent and time dependent wave equations – Physical significance of wave function – Infinite square well potential (particle in a box) – Potential barrier – Tunneling effect .

Band Theory of Solids: Origin of energy band formation – Electron in periodic potential – Kronig-Penny model (qualitative) – Classification of solids

UNIT – III

Elements of Statistical Mechanics: Maxwell-Boltzmann statistics – Bose-Einstein statistics – Fermi-Dirac statistics – Photon gas – Planck's' law of black body radiation – Wien's law and Rayleigh-Jean's law from Planck's law – Concept of electron gas (qualitative) – Fermi energy level.

UNIT – IV

Semiconductors: Intrinsic and extrinsic semiconductors – Carrier concentration in intrinsic semiconductors – Energy gap – Hall Effect – Construction & working of solar cell.

Superconductors: General properties of superconductors – Meissner's effect – Type I and Type II superconductors – BCS theory (qualitative) – Applications.

UNIT – V

Nanomaterials: Properties of materials at reduced size – Surface to volume ratio – Quantum confinement –Preparation of nanomaterials: Bottom-up approach (Sol-gel method) & Top-down approach (Ball milling method) – Elementary ideas of carbon nanotubes – Applications of nanomaterials.

Techniques for Characterization of Materials: X-ray fluorescence – Auger (OJ) process – Scanning electron microscope (SEM) – Tunneling electron microscope (TEM) – Atomic force microscope (AFM).

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 Engineering Physics", S. Chand Publications, 2014.
3. Satya Prakash, "Statistical Mechanics", Kedar Nath Ram Nath Publications, 2008.
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. M. Arumugam, "Materials Science", Anuradha Publications, 2015.
3. P.K. Palanisamy, "Engineering Physics", Scitech Publications, 2012.
4. Hitendra K Malik and A.K. Singh, "Engineering Physics", Tata McGraw Hill Education Publications, 2011

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16CS C01

PROGRAMMING AND PROBLEM SOLVING

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

Course Objective:
1. To acquire problem solving Skills.
2. To be able to write Algorithms.
3. To understand structured programming Approach.
4. To understand Memory structure.
5. To implement I/O Programming.
6. To be able to write program in C Language.

Course Outcomes: Student will be able to:
1. Develop algorithms for scientific problems.
2. Explore algorithmic approaches to problem solving.
3. Understand the components of computing systems.
4. Choose data types and structure to solve mathematical problem.
5. Develop modular programs using control structure, arrays and structures.
6. Write programs to solve real world problems using structured features.

UNIT – I
Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts.
Introduction to C Language: Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements
Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

UNIT – II
Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do-While and Examples. Continue, Break and goto statements.
Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Parameter Passing-Call-by-value, call-by-reference, Recursion**.**

UNIT – III
Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.
Arrays: Concepts, Using Arrays in C, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays.
Searching and Sorting: Linear and Binary Search, Selection Sort and Bubble Sort.

UNIT – IV
Pointers: Introduction, Pointers to Pointers, Compatibility, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command-line Arguments.
Strings: Concepts, String Input /Output Functions, Arrays of Strings, String Manipulation Functions.

UNIT – V
Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Unions, Type Definition (typedef), Enumerated Types.
Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/output Functions, Character Input/output Functions
Preprocessors: Preprocessor Commands.

Text Books:

1. Pradip Dey and Manas Ghosh “Programming in C 2/e” Oxford University Press , 2nd Edition 2011.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language” Prentice Hall India, 2nd Edition. 1990.
3. B.A.Forouzan and R.F. Gilberg A Structured Programming Approach in C, Cengage Learning,2007.

Suggested Reading:

1. Rajaraman V. "The Fundamentals of Computers" 4th Edition, Prentice Hall of India, 2006.
2. R S Bichker “programming in c” University Press ,2012.

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16ME C01

ELEMENTS OF MECHANICAL ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. Student will understand different types of engineering materials and their applications.
2. Student will come to know working principles of Petrol & Diesel engines with basic knowledge of thermodynamics.
3. Student will understand various making processes.
4. Student will come to know various power transmission devices.
5. Student will understand the importance of principles of management in industry.
6. Student will come to know aspects of various quality control techniques.

Course Outcomes: At the end of the course, students will be able to
1. Select the material depending upon requirement.
2. Evaluate performance of Petrol & Diesel engines.
3. Demonstrate his/her knowledge in preparing process chart for various machining operations.
4. Estimate the power required for various power transmitting devices like belt and gear trains.
5. Become a successful entrepreneur after studying principles of management.
6. Apply various quality control techniques after studying principles of industrial engineering.

UNIT – I
Engineering Materials: Metals and their alloys, Ductile and brittle materials, Ceramics, Polymers, Composite materials
Simple Stresses & Strains: Stress-strain diagram (for ductile and brittle materials), Poison's ratio, Young's Modulus, Rigidity modulus, Bulk modulus, Failure theories, factor of safety.

UNIT – II
Thermodynamics: Zeroth, First, Second and Third laws of thermodynamics and corollaries
I.C. Engines: Working principle of Two stroke and Four stroke SI and CI engines, Calculations of efficiencies
Heat Transfer: Fourier law of conduction in single coordinates, Newton's law of conduction, Stephens & Boltzmann law of radiation

UNIT – III
Basic Manufacturing Processes: Introduction to Welding, Brazing & Soldering, Principles of gas welding & arc welding processes, Casting, Principles of sand casting and die casting, Principles of Turning, Drilling, Milling, Grinding, Knurling, Tapping and Honing operations

UNIT – IV
Kinematics: Definitions of kinematic link, pair, mechanism and machine
Gear Trains: Simple, Compound, Inverted and Epicyclic gear trains
Belt Drives: Open and crossed belt drives, length of belts, ratio of belt tensions for flat belt, condition for maximum power transmission for flat belt
Fluid Mechanics: Definition and basic properties of fluids, types of fluids and fluid flows, stream lines, streak lines, stream function and velocity potential

UNIT – V
Industrial Engineering & Management: Introduction to scientific management, basics and importance of work study, steps in conducting work study, time study, standard time, organization and types of organization, Quality definition and its importance, introduction to quality control, types of inspection.

Text Books:

1. Jonathan Wickert and Kemper E. Lewis, An Introduction to Mechanical Engineering,3rd Ed, Cengage learning, USA, 2013
2. Yunus A. Cengel, Heat Transfer: A Practical Approach, Mcgraw-Hill, 2nd edition, 2002
3. Mahesh M Rathore, Thermal Engineering, Tata Mc Grw Hill Eduation Pvt. Ltd., 2010

Suggested Reading:

1. R K Rajput, Thermal Engineering, Laxmi Publications, 2010
2. Michael Geoffrey Stevenson, Industrial Engineering, University of N.S.W., Division of Postgraduate Extension Studies, 1972
3. PN Rao, Manufacturing Technology, Volume-I, 3rd Edition, Tata McGraw-Hill, Education, 2009
4. Thomas Bevan, Theory of Machines, 3rd Edition, Pearson Education India, 1986
5. P. N. Modi, S. M. Seth, Hydraulics and Fluid Mechanics: Including Hydraulic Machines, Standard Book House, 2011

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16EC C01

ELEMENTS OF ELECTRONICS AND COMMUNICATION ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. To understand the elementary concepts of electronic devices.
2. To study basics of Boolean algebra and working of digital circuits.
3. To understand basic operations of AM, FM, filters and multiplexing .
4. To enable the students to understand the working of commonly used communication systems.
5. To give an exposure to the selected applications.

Course Outcomes: The students will be able to
1. Familiar with the basic electronic devices and simple circuits
2. Work with Boolean algebra principles, build the simple combinational and sequential circuits
3. Appreciate the need for modulation, filtering and multiplexing
4. Understand the working principles of a few communication systems
5. Familiar to the selected applications

UNIT – I
Basics of Passive and Active devices
Classification of passive and active devices and their symbols; current flow in a semiconductor; Operating principle of a diode, its application as a rectifier; Operating principle of a transistor (BJT and JFET), Principle and use of Zener diode, Photo diode and LED.

UNIT-II
Introduction to Digital Electronics
Number systems, Binary addition and subtraction, ASCII code, Boolean algebra (Theorems and properties), Logic gates, Combinational circuits such as Half adder, Full adder and Half subtractor, Introduction to sequential logic, Basic Flip flop, Evolution of ICs, block diagram description of Microprocessor and Microcontroller.

UNIT – III
Principles of Communication Engineering (Elementary treatment only)
Basic Communication system components; Concept of Modulation, Introduction to AM, FM and comparisons; Introduction to wired and wireless communication; Concepts of filtering, LPF, HPF, BPF and BSF; concept of multiplexing, TDM and FDM.

UNIT-IV
Overview of Communication systems
Radio spectrum and applications, Modes of propagation;
Basic cellular network and concepts of a cell, frequency reuse, hand-off and cross-talk;
Basic Radar block diagram and applications; Introduction to communication satellite, Geostationary satellites and subsystems, Applications of satellites, GPS, DTH, Remote Sensing;

UNIT –V
Basic operating principles of selected applications:
Block diagram of CRO and application; Software Defined Radio (SDR)-Definition and it's block diagram; Smart phone-features; Introduction to Wireless sensor networks (Bluetooth and ZigBee), RFID-and its types, basic functions; Introduction to Modem.

Text Books:

1. "Electronic Principles" by Albert Malvino and David J Bates, 7th Edition, 2006
2. "Digital Priniciples and Applications", by Donald P Leach, Albert Paul Malvino, Gautham saha, Tata McGraw Hill,6th Edition,2009
3. "Electronic Communication Systems", by Kennedy and Davis, Tata Megra Hill Publications, 4th Edition, 2008

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16CE C03

PROFESSIONAL ETHICS AND HUMAN VALUES

Instruction	1L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	- - -
Credits	1

Course Objectives:

1. To develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. To enable the students, understand the values, the need for value adoption and prepare them meet the challenges
3. To enable the students, develop the potential to adopt values, develop a good character and personality and lead a happy life
4. To motivate the students, practice the values in life and contribute for the society around them and for the development of the institutions /organisation around they are in.
5. To make the students understand the professional ethics and their applications to engineering profession

Course Outcomes:

1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, convert everything into happiness and contribute for the happiness of others.
4. Students become potential sources for contributing to the development of the society around them and institutions/ organisations they work in.
5. Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

UNIT-I Concepts and Classification of Values –Need and challenges for value Adoption -Definition of Values – Concept of Values – Classification of Values – Hierarchy of Values – Types of Values – Interdependence of Values
Need for value education – Lack of education in values – Benefits of value education- Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges

UNIT – II: Personal Development and Values in Life
Personal Development: – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity - Integrating values in everyday life

UNIT – III: Practicing Values for the development of Society
Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atrocities – Working for the Sustainable development of the society
Principles of Integrity-Institutional Development - Vision for better India.

UNIT – IV: Basic Concepts of Professional Ethics
Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional Ethics, Ethical dilemmas, Science – Religion - Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities like Sri.M.Visweshwarayya, Dr.APJ Abdul Kalam and JRD Tata

UNIT-V: Ethics in Engineering Profession
Engineering Profession-Technology and Society- Ethical obligations of Engineering Professionals-Role and responsibility of Engineers - A few Case Studies on Risk management safety and Risk Management
Plagiarism-Self plagiarism- -Ethics Standards and Bench Marking

Text Books:

1. Subramanian R, “ Professional Ethics “ , Oxford University Press , 2013
2. Nagarajan R S, “ A Text Book on Human Values and Professional Ethics “ New Age Publications , 2007
3. Dinesh Babu S, “ Professional Ethics and Human Values “ , Laxmi Publications , 2007

Suggested Reading:

1. SantoshAjmera and Nanda Kishore Reddy , “Ethics , Integrity and Aptitude”,McGrawhill Education Private Limited, 2014
2. Govinda Rajan M, Natarajan S, Senthil Kumar V S,“Professional Ethics and Human Values”, Prentice Hall India, Private Limited,2012
3. Course Material for Post Graduate Diploma In “Value Education & Spirituality” Prepared by Annamalai University in Collaboration with Brahma Kumaris, 2010

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16CS C02

PROGRAMMING LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

1. Demonstration of control structures.
2. Demonstration of switch case (menu driven).
3. Demonstration of Parameter passing Methods.
4. Demonstration of Functions using Recursion.
5. Demonstration of arrays Operations on Matrix.
6. Implementation of bubble sort.
7. Implementation of selection sort.
8. Implementation of Linear and Binary Search.
9. Implementation of string manipulation operations with and without library function.
10. Demonstration using Pointers.
11. Demonstration of Array of Structures.
12. Sequential file operations.

Text Books:

1. Pradip Dey and Manas Ghosh “Programming in C 2/e” Oxford University Press , 2nd Edition 2011.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language” Prentice Hall India, 2nd Edition. 1990.

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16ME C03

MECHANICAL AND IT WORKSHOP

Instruction	3P Periods per week
Duration of End Examination	3 Hours
End Examination	50 Marks
Sessional	25 Marks
Credits	2

Trades for Practice 1. Fitting 2. Tin Smithy 3. Carpentry 4. House Wiring Exercises in Fitting

1. To make a perfect rectangular MS flat
2. To do parallel cuts using Hack saw
3. To drill a hole and tap it
4. To make male and female fitting using MS flats-Assembly1
5. To make male and female fitting using MS flats-Assembly2

Exercises in Tin smithy

1. To make a square tray from the given sheet metal.
2. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
3. To make a scoop.
4. To make a dust pan from the given sheet metal.
5. To make a pamphlet box.

Exercises in Carpentry

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

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

Demonstration of plumbing and welding trades .

Note: ***A minimum of 12 exercises from the above need to be done***

References:

1. Workshop Technology -- Hazra chowdary

IT Workshop

List of Tasks:

Task 1: MS Word: Formatting text, inserting images, tables, equations and hyperlinks
Document Management: Page layout techniques and printing

Task 2: MS Excel: Functions and formulas and graph plotting

Task 3: MS Power point presentation: Guidelines for effective presentation, inserting objects, charts, hyperlinks and navigation between slides

Task 4: Essentials Search Engines & Net etiquette, Plagiarism, Open source tools and other utility tools

Suggested Reading:

1. Scott Mueller's Upgrading and Repairing PCs, 18/e, Scott. Mueller, QUE, Pearson, 2008.
2. The Complete Computer upgrade and repair book, 3/e, Cheryl A Schmidt, Dreamtech

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16PY C04

APPLIED PHYSICS LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

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

1. Acquire knowledge in experiments of modern physics
2. Understand the characteristics of various semiconductor devises
3. Work with lasers and optical fibers

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

1. Understand the various applications of semiconductor devices and their suitability in engineering
2. Demonstrate the working of lasers and optical fibers and their applications in the field of communication
3. Analyze the electrical properties of a given solid based on its energy band gap
4. Verify the resistance and thermoelectric power properties with temperature variation
5. Demonstrate the concept of electron and its charge experimentally

List of Experiments:

1. Planck's Constant – Determination of Planck's Constant using photo cell
2. Solar Cell – Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance
3. Hall Effect– Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen
4. P-N Junction Diode – Study of V-I characteristics and calculation of resistance of given diode in forward and reverse bias
5. Laser – Determination of wavelength of given semiconductor red laser
6. Fibre Optics – Determination of NA and power losses of given optical fibre
7. Energy Gap – Determination of energy gap of given semiconductor
8. Thermistor – Determination of temperature coefficient of resistance of given thermistor
9. *e/m* of Electron by Thomson's Method
10. Thermoelectric Power – Determination of thermoelectric power of given sample

Note: A student must perform a minimum of eight experiments.

Suggested Reading:

1. "Applied Physics"- Manual by Department of Physics, CBIT, 2016
2. S.K. Gupta, "Engineering Physics Practical", Krishna's Educational Publishers, 2014
3. O.P. Singh, V. Kumar and R.P. Singh, "Engineering Physics Practical Manual", Ram Prasad & Sons Publications, 2009

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16CY C03

ENGINEERING CHEMISTRY LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory
2. For practical understanding of theoretical concept of chemistry

Course Outcomes:

1. This syllabus helps the student to understand importance of analytical instrumentation for different chemical analysis.
2. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.

List of Experiments:

1. Introduction to chemical analysis.
2. Preparation of standard solution of oxalic acid and Standardization of NaOH
3. Estimation of amount of Fe^{+2} in the given solution using Mohr's salt and $KMnO_4$
4. Estimation of amount of Fe^{+2} in the given solution using Mohr's salt and $K_2Cr_2O_7$
5. Estimation of amount of copper in the given solution using hypo solution.
6. Estimation of amount of HCl pH metrically using NaOH solution
7. Estimation of amount of CH_3COOH pH metrically using NaOH solution
8. Determination of concentration of given KMnO4 solution Colorimetrically
9. Determination of concentration of given $K_2Cr_2O_7$ solution Colorimetrically
10. Distribution of acetic acid between n-butanol and water.
11. Distribution of benzoic acid between benzene and water
12. Preparation of urea – formaldehyde / phenol- formaldehyde resin.

Suggested Reading:

1. Vogel' S text book of quantitative chemical analysis by J. Mendham and Thomas,Person education Pvt.Ltd New Delhi ,6th ed. 2002
2. Laboratory Manual on Engineering Chemistry by Dr. Subdharani (Dhanpat Rai Publishing)
3. A Textbook on experiment and calculation in engineering chemistry by S.S. Dara S.Chand
4. Instrumental methods of Chemical Analysis, MERITT & WILLARD East-West Press).

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Choice Based Credit System (with effect from 2016-17)

B.E (Civil, EEE, Mech. and Prod.) and B.Tech (Chemical)

II - Semester						
S.No	**Code**	**Subject**	**L**	**T**	**P/D**	**Credits**
1	16MT C02	Engineering Mathematics - II	3*	-	0	3
2	16PY C01	Engineering Physics	3	-	0	3
3	16CY C02	Applied Chemistry	2	-	0	2
4	16EE C01	Elements of Electrical Engineering	3	-	0	3
5	16CE C01	Engineering Mechanics	3	-	0	3
6	16EG C01	Professional Communication in English	3	-	0	3
7	16CE C02	Environmental Studies	1	-	0	1
8	16ME C02	Engineering Graphics	1	-	3	3
9	16PY C03	Engineering Physics Laboratory	0	-	2	1
10	16CY C04	Applied Chemistry Laboratory	0	-	2	1
11	16EG C02	Professional Communication Laboratory	0	-	2	1
TOTAL			**19**	**--**	**09**	**24**

L - Lecture (clock hours) T - Tutorial (clock hours) P/D - Practical / Drawing (clock hours)

* One extra hour may be permitted in the timetable

16 MT C02

ENGINEERING MATHEMATICS – II

Instruction	3L Periods per week + 1 (extra hour)
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To know the relevant methods to solve higher order differential equations.
2. To learn the Laplace and Inverse Laplace transforms for solving engineering problems.
3. To know improper integrals such as Beta, Gamma functions.
4. To learn Vector Differential Operator and its physical interpretations.
5. To evaluate vector line, surface & volume integrals.
6. Learn to apply all the above mathematical methods/techniques to interpret the results in physical and technical terms.

Course outcomes:

1. Solve the solutions of Differential Equations which arise in electrical circuits, vibrations and other linear systems.
2. Able to solve solutions of differential equations with initial and boundary value problems.
3. Evaluating definite integrals using Beta, Gamma functions.
4. Understating the significance of gradient, divergent and Curl.
5. Use Greens, Gauss and Stoke‟s theorems to find the surface and volume integrals.
6. Able to solve and analyse the Engineering problems.

UNIT-I Ordinary differential Equations: Linear Differential equations of higher order with constant coefficients, complementary function and particular integrals when RHS is of the forms e^{ax} , sin ax , cos ax , x^m , e^{ax} (v), x^m (v),where v-is a function of x, Cauchy‟s equation, electrical circuits of second order

UNIT-II Laplace Transforms: Laplace transforms of standard functions, Laplace transforms of piecewise continuous functions, first shifting theorem, multiplication by „t‟, division by „t‟. Laplace transforms of derivatives and integrals of functions-Unit step function-Periodic functions (without proofs). Inverse Laplace transforms-by partial fractions (Heaviside method), Convolution Theorem, Solving Ordinary differential equations by Laplace Transforms

UNIT-III Beta and Gamma Functions: Definitions of Beta and Gamma functions-elementary Properties of both Beta and Gamma functions, Relation between Beta and gamma functions, differentiation under the integral sign.

UNIT-IV Vector Differentiation: Scalar and vector fields- directional derivative- Gradient of a scalar-Divergence and Curl of a vector point function. Properties of divergence, curl, Solenoidal and Irrotational vectors

UNIT-V Vector Integration: Evaluation of Vector Line integrals, surface integrals and volume integrals, Greens, Gauss divergence and Stokes theorems (without proofs) and its applications

Text Books:

1. Erwin Kreyszig "Advanced Engineering Mathematics,"10th edition, John Wiley & Sons -Publishers.
2. R.K.Jain & S.R.K.Iyenger "Advanced Engineering Mathematics" , 3rd edition, Narosa Publications
3. Alen Jaffery "Mathematics for Engineers & Scientists" , 6th ed 2013 CRC press, Taylor & Francis Group. (Elsevier)
4. Dr.B.S.Grewal "Higher Engineering Mathematics", 43rd edition, Khanna Publishers.

Suggested Reading: (for further reading and examples on applications)

1. A.Craft and Robert Davison "Mathematics for Engineers-a modern interactive approach" -Willey
2. Loius Pipes "Applied Mathematics and physicists" Mc Graw Hill publishers.
3. Kanti.B.Datta "Mathematical Methods of Science & Engg," Aided with MATLAB,. Cengage Learning India Pvt.Ltd.
4. AR Collar and A. Simpson "Matrices for Engineering Dynamics" -John Willey & sons.

16PY C01

ENGINEERING PHYSICS

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives: The objective of the course is to make the student
1. Understand the general concepts of physics
2. Acquire knowledge of different kinds of waves and their behavior
3. Familiar with crystal physics and materials
4. To introduce the general concepts of physics

Course Outcomes: At the end of the course, the student will be able to
1. Describe the types of oscillations and analyze them
2. Demonstrate the wave nature of the light
3. Develop the concepts related to electromagnetic behavior
4. Identify the various crystal systems and defects
5. Explain the origin of magnetism and dielectric polarization and applications of these materials in the field of engineering & technology

UNIT – I Waves and Oscillations: Review of free oscillations - Superposition of two mutually perpendicular linear SHMs of same frequency and 1:2 ratio frequency – Lissajous figures – Damped vibrations – Differential equation and its solution – Logarithmic decrement - Relaxation time – Quality factor – Forced vibrations – Differential equation and its solution – Amplitude resonance-Torsional pendulum.
Ultrasonics: Production of ultrasonics by piezoelectric and magnetostriction methods – Detection of ultrasonics – Determination of ultrasonic velocity in liquids – Applications.

UNIT – II Interference: Division of amplitude – Interference in thin films (reflected light) – Newton‟s rings – & division of wavefront – Fresnel‟s biprism.
Diffraction: Distinction between Fresnel and Fraunhoffer diffraction – Diffraction at single slit – Diffraction grating (N Slits) – Resolving power of grating.

UNIT – III Polarization: Malus‟s law – Double refraction – Nicol‟s prism – Quarter & Half wave plates – Optical activity – Laurent‟s half shade polarimeter.
Electromagnetic Theory: Review of steady and varying fields – Conduction and displacement current – Maxwell‟s equations in differential and integral forms – Electromagnetic wave propagation in free space, dielectric and conducting media – Poynting theorem.

UNIT – IV Crystallography: Space lattice - Crystal systems and Bravais lattices – Crystal planes and directions (Miller indices) – Interplanar spacing – Bragg‟s law – Lattice constant of cubic crystals by powder diffraction method.
Crystal Imperfections: Classification of defects – Point defects – Concentration of Schottky and Frenkel defects – Line defects – Edge dislocation – Screw dislocation – Burger‟s vector.

UNIT – V Magnetic Materials: Classification of magnetic materials – Langevin theory of paramagnetism – Weiss molecular field theory – Domain theory – Hysteresis curve – Structure of ferrites (spinel & Inverse spinel) – Soft and hard magnetic materials.
Dielectric Materials: Dielectric polarization – Types of dielectric polarization: electronic, ionic, orientation and space-charge polarization (Qualitative) – Frequency and temperature dependence of dielectric polarization – Determination of dielectric constant (Schering bridge method) – Ferroelectricity – Barium titanate – Applications of ferroelectrics.

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 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”, McGahill Education Publications, 2013
3. P.K. Palanisamy, Engineering Physics”, Scitech Publications, 2012
4. V. Raghavan, “Materials Science and Engineering”, Prentice Hall India Learning Private Ltd., 6th Revised edition, 2015

16CY C02

APPLIED CHEMISTRY

Instruction	2L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	20 Marks
Credits	2

Course Objectives:

Applied chemistry is a fascinating area with the profound implications for engineers as well as biologists. Materials fabricated and used in our daily life are derived from chemicals, both natural and synthetic and their range of utility are growing day by day. It is imperative that engineers of different disciplines acquire sufficient knowledge of the materials and their characteristics for making proper selection of their end -use application.

The various units of the syllabus is so designed to fulfill the following objectives.

1. To impart technological aspects of modern chemistry and to lay foundation for the application of chemistry in engineering and technology disciplines
2. The student should be conversant with the
   i. Principles of water characterization and treatment of water for potable and industrial purposes.
   ii. Principles of polymer chemistry and engineering applications of polymers in domestic and engineering areas
3. Knowledge to prevent corrosion of machinery and metallic materials and water chemistry which require serious attention in view of increasing pollution, has been included in the syllabus.
4. Study of polymers is insisted as it gives better insight to industrial personnel by being exposed to wider aspects of polymer science.
5. Study of fuel cells is given importance as fuel cells are the alternate energy sources for generating electrical energy on spot and portable applications.
6. Newer materials lead to discovering of technologies in strategic areas like defense and space research. Recently modern materials synthesized find applications in industry and technology and in order to emphasize them, topics like composite materials, polymers, conducting polymers and nano materials have been incorporated in the curriculum.
7. To enable students to apply the knowledge acquired in improving the properties of engineering materials.
8. To give an insight into nano materials and composite materials aspect of modern chemistry.

Course Outcomes:

1. At the end of the course, the students will be familiar with the fundamentals of water technology; corrosion and its control; applications of polymers in domestic and engineering areas; nano materials and their applications.
2. The engineer who has the above background can effectively manage the materials in his designing applications and for discovering & improving the systems for various uses in industry, agriculture, health care, technology, telecommunications and electronics.
3. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.
4. Study of nano related materials helps to update the knowledge necessary to launch into the demands of the world.

UNIT –I

Water Chemistry: Hardness of water – Types, units of hardness, Disadvantages of hard water - Boiler troubles - scales & sludge formation - causes and effects, softening of water by ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water, disinfection of water by chlorination, Ozonization, UV radiation.

UNIT -II

Corrosion Science : Introduction, chemical corrosion – oxidation corrosion , electro chemical corrosion and its mechanism , Galvanic corrosion and types of differential aeration corrosion (waterline corrosion) , Factors affecting corrosion (position of the metals in galvanic series, relative areas of anode and cathode, nature of corrosion product – solubility and volatility of corrosion product, nature of corroding environment – temperature, humidity and P^H. Corrosion control methods – cathodic protection, sacrificial anodic protection

UNIT – III

High Polymers: Definition of polymer, degree of polymerization. Thermo plastics and thermo sets. Preparation, properties and uses of plastics (Polyvinyl chloride, Bakelite), fibers (Kevlar, polyurethane), Rubbers – natural rubber and its chemical structure, vulcanization and its significance. Preparation, properties and uses of silicone rubber, conducting polymers – definition, classification and applications

UNIT – IV

Battery Technology: Types of batteries - Primary batteries - Dry cell, Lithium battery; Secondary batteries - lead acid storage cell , Lithium ion battery ; Fuel cell - H_2-O_2 fuel cell, methanol-oxygen fuel cell – its advantages and applications
Solar cells – photo voltaic cells

UNIT–V

Engineering Materials: Nano materials – Introduction to nano materials and general applications, basic chemical methods of preparation – Sol-gel method. Carbon nanotubes and their applications
Composite materials – definition, types of composites, fibre reinforced, glass fibre reinforced and carbon fibre reinforced composites and applications.

Text Books:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Pub, Co., New Delhi (2002)
2. Applied Chemistry "A text for Engineering & Technology" Springer (2005).
3. ShasiChawla, "Text Book of Engineering Chemistry", Dhanpat Rai Publishing Company, NewDelhi (2008).
4. S.S. Dara "A text book of engineering chemistry" S.Chand & Co.Ltd., New Delhi (2006).
5. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
6. Applied Chemistry by N. Krishnamurthy:P. Vallinavagam. And K. Jeysubramanian TMH
7. Chemistry of Engineering Materials by CV Agarwal,C.P Murthy, A.Naidu, BS Publications.
8. Chemistry of Engineering Meterials by R.P Mani and K.N.Mishra, CENGAGE learning

Suggested Reading:

1. B.K.Sharma, "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001)
2. Water Treatment : F. I. Bilane, Mir publisher
3. Fundamentals of Corrosion: Michael Henthorne, Chemical Engineering.
4. A textbook of Polymer Science: Fred, Billmeyer Jr., Wiley India Third edition.
5. Chemistry of Advanced Materials: CNR Rao, Rsc Publication.
6. Materials Science and Engineering an Introduction, William D. Callister, (Jr. Wiley publisher).
7. Introduction to nano materials by T.Pradeep.

16EE C01

ELEMENTS OF ELECTRICAL ENGINEERING

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:
1. To understand the basic concepts of electrical circuits.
2. To understand the principles of electromagnetic induction.
3. To know about different types of batteries, charging and discharging of batteries and types of fuel cells etc.
4. To know about different types of electrical wires and cables, domestic and industrial wiring.
5. To understand safety rules and methods of earthing.

Course Outcomes: After completion of the course, the student will be able to:
1. Acquire the knowledge of basic concepts of electrical circuits such as Ohm"s law, Kirchhorff"s laws etc.
2. Acquire the knowledge of basic Faraday"s laws of electromagnetic induction.
3. Acquire the knowledge to solve the problem of AC circuits.
4. Acquire the knowledge of specifications of batteries, types of cells and sources of renewable energy.
5. Acquire the knowledge of electrical wiring and cables and their types and electrical equipment and their specification.
6. Acquire the knowledge of safety precautions in handling electrical appliances, importance of grounding and methods of earthing.

UNIT-I DC Circuits
Current, voltage, power and energy, sources of electrical energy, independent and dependent sources, source conversion, circuit elements, Resistor, Inductor, Capacitor Ohm"s law, Kirchhoff"s laws, analysis of series, parallel and series-parallel circuits, star-delta conversion, Node and Mesh analysis (with independent sources only).

UNIT-II : Electromagnetism & AC Circuits Electric charge, electric field, lines of force, electric field intensity, electric flux and flux density, Faraday"s laws of electromagnetic induction, static and dynamically induced EMF.
A.C. Circuits: Generation of alternating voltage and current, equation of alternating voltage and current, average and rms values of sinusoidal quantities, form and peak factors, phasor representation of sinusoidal quantities, AC through pure resistance pure Inductance, pure capacitance, RL,RC,RLC circuits.

UNIT-III: Batteries and Fuel Cell
Introduction to batteries, simple cell, EMF and internal resistance of a cell, primary and secondary cells, cell capacity, types and specifications of batteries, charging and discharging of battery, safe disposal of batteries; fuel cell, principle and types of fuel cell, different sources of renewable energy.

UNIT-IV: Electrical Wiring
Types of wires and cables, types of connectors and switches, system of wiring, domestic and industrial wiring, simple control circuit in domestic installation, electrical equipment and their specifications

UNIT-V: **Safety & Protection**
Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, other electrics hazards, safety rules, importance of grounding and earthing of electrical equipment, methods of earthing, circuit protection devices: Fuses, MCB, ELCB and Relays.

Text Books:
1. Edward Hughes, "Electrical and Electronics Technology", 10th Edition, Peasson Publishers 2010.
2. V.K. Mehta & Rohit Mehta, "Principles of Electrical Engineering", S.Chand Company Limited 2008
3. B.L. Theraja & A.K. Theraja, "Electrical Technology", Vol.I, S.Chand Company Limited 2008.

Suggested Reading:
1. P.V.Prasad & S. Siva Nagraju, "Electrical Engineering: Concepts & Applications", Cengage Learning, 2012.
2. S. Rao, "Electrical Safety, fire safety engineering & Safety Management", Khanna publications, 1998.
3. Surjit singh & Ravi Deep Singh, "Electrical Estimating and Costing", Dhanapath Rai & Co., 1997.

16CE C01

ENGINEERING MECHANICS

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives: During this course, students should develop the ability to:

1. Work comfortably with basic engineering mechanics concepts required for analyzing static structures
2. Identify an appropriate structural system to study a given problem and isolate it from its environment.
3. Analyze and model the problem using free-body diagrams and equilibrium equations
4. Apply pertinent principles to the system to solve and analyze the problems subjected to frictional forces.
5. Understand the meaning of centroid/ centers of gravity and moments of Inertia using integration methods.
6. Communicate the solution to all problems in an organized and coherent manner and elucidate the meaning of the solution in the context of the problem.

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

1. Solve problems dealing with forces in planar force systems
2. Draw free body diagrams to analyze the forces in the given structure
3. Understand the concept of moments and couples in plane systems.
4. Understand the mechanism of friction and can solve friction problems
5. Determine the centroid of plane areas and centers of gravity of bodies using integration methods
6. Determine moments of inertia, product of inertia for all areas and mass moments of inertia for bodies,

UNIT – I

Force Systems: Resolution of coplanar and non-coplanar force systems (both concurrent and non-concurrent), Determining the resultant of planar force systems. Moment of force and its applications and couples

UNIT – II

Equilibrium of force system: Free body diagrams, equations of equilibrium of planar force systems and its applications. Problems on general case of force systems

UNIT – III

Theory of friction: Introduction, types of friction, laws of friction, application of friction to a single body & connecting systems. Wedge and belt friction

UNIT– IV

Centroid: Significance of centroid, moment of area, centroid of line elements, plane areas, composite areas, theorems of Pappus & its applications. Center of gravity for elementary and composite bodies

UNIT – V

Moment of Inertia: Definition of MI, Polar Moment of Inertia, radius of gyration, transfer theorem, moment of Inertia of elementary & composite areas, product of inertia. Mass moments of inertia for elementary and composite bodies

Text Books:

1. K. Vijay Kumar Reddy and J. Suresh Kumar, Singer‟s Engineering Mechanics, BS Publications, Hyderabad, 2011.
2. Ferdinand L Singer, Engineering Mechanics, Harper and Collins, Singapore, 1904.

Suggested Reading:

1. A. Nelson, Engineering Mechanics, Tata McGraw Hill, New Delhi, 2010.
2. S. Rajashekaran & G. Sankarasubramanyam, Engineering Mechanics, Vikas publications, Hyderabad, 2002.
3. S.B. Junarkar and H.J Shah, Applied Mechanics**,** Charotar publishers, New Delhi, 2001.
4. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press, New Delhi, 2008.
5 A K Tayal, Engineering Mechanics, Umesh Publications, New Delhi, 2010

16EG C01

PROFESSIONAL COMMUNICATION IN ENGLISH

Instruction	3L Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To enable the students to understand the role and importance of communication and to develop their basic communication skills in English.
2. To strengthen the students‟ usage of grammar and to develop their vocabulary.
3. To improve the students‟ listening skills and introduce them to different reading strategies.
4. To equip the students with appropriate writing skills.
5. To enhance imaginative and critical thinking through literary texts and book review.

Course Outcomes: The students will

1. Understand the nature, process and types of communication and will communicate effectively without barriers.
2. Understand the nuances of listening and will learn to make notes
3. Read different texts, comprehend and draw inferences and conclusions.
4. Write effective paragraphs, letters and reports
5. Critically analyze texts and write book reviews

UNIT- I Understanding Communication in English: Introduction, nature and importance of communication. Process of communication. Basic types of communication - verbal and non verbal. One way vs. Two way communication. Barriers to communication. Intrapersonal and interpersonal communication. Johari Window.

Grammar & Vocabulary: Parts of speech, figures of speech – Euphemism, Hyperbole, Irony, Metaphor, Onomatopoeia, Oxymoron, Paradox, Personification, Pun & Simile

UNIT- II Developing Listening Skills: Exposure to recorded and structured talks, class room lectures- problems in comprehension and retention. Types of listening, barriers to listening, effective listening strategies. Note –taking.

Grammar & Vocabulary: Articles, Prepositions, Phrasal verbs, Idioms.

UNIT- III Developing Writing Skills: Sentence structure. Brevity and clarity in writing. Cohesion and coherence. Paragraph writing. Letter writing - form and structure, style and tone. Kinds of Letters –Apology and request letters. Email etiquette. Report writing.

Grammar & Vocabulary: Tense, Conditionals, homonyms, homophones.

UNIT - IV Developing Reading Skills: The reading process, purpose, different kinds of texts. Reading comprehension. Techniques of comprehension – skimming, scanning, drawing inferences and conclusions. Note-making

Grammar &Vocabulary: Concord, Connectives, Active and Passive voice, Words often confused.

UNIT- V: Reading for Enrichment

1. The Road Not Taken — Robert Frost
2. Goodbye Party For Miss Pushpa T. S — Nissim Ezekiel
3. The Open Window — Saki
4. The Romance Of A Busy Broker — O. Henry

Book reviews -Oral and written review of a chosen / novel/ play - a brief written analysis including summary and appreciation. Oral presentation of the novel/play

Grammar & Vocabulary: Indianisms, Common errors, Parallelisms.

Text Books:

1. Vibrant English, Orient Blackswan Ltd,

Suggested Reading:

1. M .Ashraf Rizvi, Effective Technical Communication, Tata Mc Graw- Hill, New Delhi
2. Meenakshi Raman and Sangeetha Sharma, Technical Communication - Principles and Practice, Oxford Univ. Press, New Delhi.
3. Sunil Solomon, English for Success, Oxford University Press, 2015
4. Krishna Mohan, Meera Banerji, Developing Communication Skills, McMillan India Ltd.
5. Michael McCarthy, English Vocabulary in Use.
6. Brikram K Das, Kalyani Samantray, An Introduction to Professional English and Soft Skills Cambridge Univ. Press, New Delhi.

16CE C02

ENVIRONMENTAL STUDIES

Instruction	1L Periods per week
Duration of End Examination	2 Hours
End Examination	50 Marks
Sessional	- - -
Credits	1

Course Objectives:
1. To equip the students with inputs on the environment, natural resources and their conservation.
2. To study the interrelationship between the living organisms and the natural environment and also to enable the students to understand the structure and functioning of the ecosystems.
3. To understand the importance of biodiversity and create awareness on its threats and conservation strategies.
4. To enable the students become aware of pollution of various environmental segments including their causes, effects and control measures.
5. To create awareness about environmental legislations in the context of national conventions.

Course Outcomes: At the end of the course, the student should have learnt
1. To understand the scope and importance of environmental studies, identify the natural resources and ecosystems and contribute for their conservation.
2. To understand the ecological services of biodiversity and contribute for their conservation.
3. To develop skills to solve the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
4. To relate the social issues and the environment and contribute for the sustainable development.
5. To understand the essence of the ethical values of the environment for conserving depletable resources and pollution control.

UNIT – I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Water resources- hydrological cycle, use and over utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Food resources- Changes caused by modern agriculture, fertilizers-pesticide problems, water logging and salinity. Forest resources- use and over exploitation, deforestation. Mineral resources- Use and exploitation, effects of mining. Energy resources- Growing energy needs, various renewable and non-renewable energy sources. Land resources- land as a resource, land degradation- causes and effects, Role of individuals in conservation of natural resources.

UNIT – II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, concept of food chains, food webs, ecological pyramids.

UNIT – III

Biodiversity: Types/classification of biodiversity, India as a mega diversity nation, values of biodiversity, threats to biodiversity, Conservation of biodiversity.

UNIT – IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, Soil pollution, Noise pollution and Thermal pollution.

Environmental Legislations: Environment protection act, Air, Water, Forest & Wild life acts.

UNIT – V

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development, Population explosion and Climate change: Global warming, Acid rain, Ozone layer depletion.

Text Books:

1. P. D.Sharma, “Ecology & Environment”, Ashish publications, 1994

2. Y. Anjaneyulu, “Introduction to Environmental Science”, B S Publications, 2004

Suggested Reading:

1. Dr. Suresh K. Dhameja, “Environmental Studies”, S. K. Kataria & Sons, 2009
2. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley, 1991
3. S. S. Dara, “A Text Book of Enviromental Chemistry & Polution Control”, S. Chand Limited, 2006

16ME C02

ENGINEERING GRAPHICS

Instruction	1L + 3D Periods per week
Duration of End Examination	3 Hours
End Examination	70 Marks
Sessional	30 Marks
Credits	3

Course Objectives:

1. To provide an exposure in understanding the drawings during a multidisciplinary approach towards a problem
2. To train up in perception and imagination of a three dimensional scenario.

Course Outcomes:

1. To understand theory of projections
2. Ability to improve visualization skills
3. Ability to sketch Engineering Objects

UNIT – I

Introduction to Engineering Drawing: Drawing Instruments and their uses, types of lines, use of pencils, Lettering, Rules of dimensioning

Conic Sections: Ellipse, Parabola, Hyperbola including the Rectangular Hyperbola (General method only)

Cycloidal curves: Construction of cycloid, epi-cycloid, hypo-cycloid & involutes

UNIT – II

Orthographic Projections: Principles of Orthographic Projections – Conventions , Projection of Points, Projection of Lines - inclined to both planes.

UNIT – III

Projections of Planes: Projections of regular Planes – Perpendicular planes and Oblique planes.

UNIT – IV

Projections of Solids: Projections of Regular Solids – Regular Polyhedra, solids of revolution, (Simple position only)

Sections of Solids: Types of cutting planes – their representation – sections of solids in simple position.

UNIT – V

Introduction to Graphic packages: Getting started, Basic drawing and editing commands, creating lines, planes and solids.

Note: Syllabus for external examination will be from unit 1 to unit 4 only & unit-5 is exempted from external examination. Unit 5 is for internal examination only.

Text Books:

1. N.D.Bhatt," Elementary Engineering Drawing", Charotar Publishers, 2012
2. Basanth Agrawal and C M Agrawal "Engineering Drawing 2e ", McGraw-Hill Education(India) Pvt. Ltd.

Suggested Reading:

1. K.L.Narayana and P.K.Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011
2. P.S.Gill" "Engineering Graphics", Kataria Publications, 2011
3. K.Veenugopal, "Engineering Drawing and Graphics + Autocad", New Age International Pvt. Ltd, 2011
4. Shaw M.B and Rana B.C., "Engineering drawing", Pearson, 2nd edition, 2009
5. P I Varghees, " Engineering Graphics ",Tata McGraw-Hill publications, 2013
6. Bhattacharya. B, "Engineering Graphics", I. K. International Pvt. Ltd, 2009
7. Dhawan R.K., "Principles of Engineering Graphics and Drawing", S. Chand, 2011

16PY C03

ENGINEERING PHYSICS LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

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

1. Apply theoretical physics knowledge in doing experiments
2. Understand the behavior of the light experimentally
3. Analyze the behavior of magnetic and dielectric materials

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

1. Understand the concept of errors and find the ways to minimize the errors
2. Demonstrate interference and diffraction phenomena experimentally
3. Distinguish between polarized and unpolarized light
4. Determine the loss of energy of a ferromagnetic material and its uses in electrical engineering
5. Understand the suitability of dielectric materials in engineering applications

List of 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 mercury light
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. B-H Curve – Determination of hysteresis loss of given specimen
9. Dielectric Constant – Determination of dielectric constant of given PZT sample
10. Ultrasonic Interferometer – Determination of velocity of ultrasonics in given liquid

Note: A student must perform a minimum of eight experiments.

Suggested Reading:

1. "Engineering Physics" - Manual by Department of Physics, CBIT, 2016
2. S.K. Gupta, "Engineering Physics Practical", Krishna‟s Educational Publishers, 2014
3. O.P. Singh, V. Kumar and R.P. Singh, "Engineering Physics Practical Manual", Ram Prasad & Sons Publications, 2009

16CY C04

APPLIED CHEMISTRY LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives:

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory
2. For practical understanding of theoretical concept of chemistry.
3. The student should be conversant with the principles water characterization and treatment of potable and industrial purposes.

Course Outcomes:

1. This syllabus helps the student to understand importance of analytical instrumentation for different chemical analysis.
2. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.

LIST OF EXPERIMENTS

1. Introduction to chemical analysis
2. Preparation of standard solution of oxalic acid and Standardization of NaOH
3. Estimation of amount of oxalic acid in the given solution using Mohr‟s salt and $KMnO_4$
4. Estimation of total hardness of water using EDTA solution
5. Estimation of temporary hardness and permanent hardness of water using EDTA solution
6. Estimation of amount of carbonate in the given solution using HCl link solution
7. Estimation of amount of carbonate and bicarbonate in the given solution using HCl link solution
8. Estimation of amount of HCl conductometerically using NaOH solution
9. Estimation of amount of CH_3COOH conductometerically using NaOH solution
10. Estimation of amount of HCl and CH_3COOH present in the mixture of acids conductometerically using NaOH solution
11. Estimation of amount of HCl potentiometrically using NaOH solution
12. Estimation of amount of Fe^{+2} potentiometrically using $KMnO_4$ solution

Suggested Reading:

1. Applied Chemistry: Theory and Practice (Latest ed.), By O.P. Vermani & A.K. Narula
2. Vogel‟s Textbook of Quantitative Chemical Analysis (Latest ed.), Revised by G.H. Jeffery, J. Bassett, J. Mendham & R.C. Denney
3. Instrumental methods of Chemical Analysis, MERITT & WILLARD East-West Press

16EG C02

PROFESSIONAL COMMUNICATION LABORATORY

Instruction	2P Periods per week
Duration of End Examination	2 Hours
End Examination	35 Marks
Sessional	15 Marks
Credits	1

Course Objectives:

1. To introduce students to phonetics and the different sounds in English.
2. To familiarize the students with the software and give them sufficient practice in correct pronunciation.
3. To enable students to speak English correctly with focus on stress and intonation.
4. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
5. To understand team work, role behavior and to develop the ability to analyze, evaluate, construct and refute arguments.

Course Outcomes:

1. The students will understand the speech sounds in English and the nuances of pronunciation.
2. The students will understand tone, intonation and rhythm and apply stress correctly.
3. The students will be able to participate in group discussions with clarity and confidence.
4. The students will speak confidently on stage with appropriate body language.
5. The students will debate on various issues and learn to work in teams.

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. **Aspects of connected speech**: Strong forms, weak forms, contracted forms, elision.
4. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
5. **Rhythm & Intonation**: Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
6. **Listening skills** – practice with IELTS and TOEFL material
7. **Situational dialogues and role play**
8. **Public speaking** is to be shown by incorporating narrative examples and extracts from speeches.
9. **Group Discussions**– videos to be shown and practice sessions
10. **Poster making** – preparation and presentation
11. **Debate** - Differences between a debate and a group discussion. Essentials of a debate, conducting a debate.

Suggested Reading:

1. E Suresh kumar et al, . English for Success (with CD), Cambridge University Press India Pvt Ltd. 2010.
2. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016
3. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
4. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
5. Edgar Thorpe. Winning at Interviews, Pearson Education, 2006
6. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd 2011

Choice Based Credit System (CBCS)

Name of the Programme (UG): B.Tech

Syllabus for III - Semester and IV - Semester

With effect from 2017 - 2018

Specialization /Branch: Chemical Engineering

Chaitanya Bharathi Institute of Technology (A)

Chaitanya Bharathi (P.O), Gandipet

Hyderabad-500075, Telangana State.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
Choice Based Credit System
B.Tech (Chemical Engineering)

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	16MT C03	Engineering Mathematics-III	3	-	3	30	70	3
2	16CH C01	Chemical Technology	3	-	3	30	70	3
3	16CH C02	Fluid Mechanics	3	-	3	30	70	3
4	16CH C03	Material and Energy Balance	3	-	3	30	70	3
5	16CY C07	Physical Chemistry	3	-	3	30	70	3
6	16MB C01	Engineering Economics and Accountancy	3	-	3	30	70	3
PRACTICALS								
7	16CH CO4	Chemical Technology Lab	-	3	3	25	50	2
8	16CY C08	Physical Chemistry Lab	-	3	3	25	50	2
9	16ME C13 /16EE C05	Basics of Mechanical and Electrical Engg. Lab	-	3	3	25	50	2
		Total	**18**	**9**	**-**	**255**	**570**	**24**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester and Examination

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AssessmentProcedures for Awarding Marks

The distribution of marks is based on CIE by concerned teacher and the Semester end examination shall be as follows:

Course (in terms of credits)	CIE	Semester end Examination(Marks)	Remarks	Duration of SemesterEnd Examination
Three(3) Credits/ Four(4) Credits	30*	70**	Theory Course/ Engg.Graphics	3 Hours
Two(2) Credits	20*	50***	Theory	2 Hours
Two(2) Credits	25	50	Lab Course/ Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
Two(2) Credits	50	—-	Project Seminar/ Seminar	——
Six(6) Credits	50	100	Project	Viva-Voce
One(1) Credit	—-	50***	Environmental Studies,Profess-ional Ethics and Human values	2 Hours
One(1) Credit	50		Mini Project	——-

CIE: Continuous Internal Evaluation

*Out of 30/20 sessional marks(CIE), 10/5 marks are allotted for slip-tests (Three slips test will be conducted, each of 10/5 marks, best two average is considered) and the remaining 20/15 marks are based on the average of two tests, weightage for each test is 20/15 marks.

**The question paper will be in two parts, Part-A and Part-B. Part A is for Ten(10) questions and is compulsory, covers 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).

***The question paper will be in two parts, Part-A and Part-B. Part A is for Ten(10) questions and is compulsory, covers the entire syllabus, and carries 15 marks. Part-B carries 35 marks and covers all the units of the syllabus (student has to answer five out of seven questions).

Note: A course that has CIE (sessional marks) but no semester end examination 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 for theory course is 40% of total marks i.e., CIE plus semester end examinations where as for the lab course/project is 50%.

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16MT C05

ENGINEERING MATHEMATICS-III

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

Course objectives:

1. To study the expansion of functions in various intervals.
2. To form P.D.E and to find its solution.
3. To solve Wave, Heat & Laplace equations.
4. To learn Differentiation and Integration of complex valued functions.
5. To evaluate Complex Integration.
6. To evaluate Real definite integrals.

Course outcomes: On the successful completion of this course the student will be able to

1. Expand functions in the given intervals.
2. Solve linear and non linear PDEs.
3. Solve one-dimension, two-dimension, Heat steady state equations and also one-dimension wave equation.
4. Solve problems on Analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Expand functions by using Taylor's and Laurent's series.
6. Solve Real and Complex integrals by using Cauchy Theorems.

UNIT – I

Fourier series: Definition of Periodic, Single valued, finite maxima and minima of functions. Euler's Formulae, Dirichlets Conditions for Fourier expansion, Functions having points of discontinuity, Change of interval, Expansion of odd and even functions, Half-range sine series and cosine series.

UNIT-II:

Partial differential equations: Formation of partial differential equations by eliminating the arbitrary constants or arbitrary functions, solutions of linear partial differential equation of first order by using Lagrange's Method, solution of Non-linear partial differential equations of first order by using standard types, Charpit's Method.

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UNIT - III

Applications of Partial differential equations: Solution of partial differential equations by using method of separation of variables, solution of vibration of a stretched string (1D-Wave equation), one dimensional heat equation, Two dimensional heat equation under steady state conditions.

UNIT - IV

Theory of Complex variables: Analytic functions, Cauchy Riemann equations (Cartesian and polar forms), construction of Analytic functions by using Milne-Thomson's method. Harmonic function. Complex line integrals, Cauchy's theorem, Cauchy's Integral formula and its derivatives and problems related to the above theorems.

UNIT - V

Expansion of functions, Singularities & Residues: Taylor's and Laurent's series Expansions (Only statements). Zeros, types of singularities, Residues and Cauchy's Residue theorem, Evaluation of real integrals by Cauchy's residue theorem. Evaluation of improper real integrals of the type: $\int_{-\infty}^{\infty} f(x)dx$ Where f(x) has no poles on real axis and $\int_0^{2\pi} f(\sin\theta, \cos\theta)d\theta$.

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2015.
2. M.D. Raisinghania, "Advanced Differential equations", 7th edition, S Chand publishers, 2013.
3. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7th edition, McGraw Hill publishers, 2003.

Suggested Reading:

1. N P Bali and Manish Goyal, "A Text Book of Engineering Mathematics", 9th Edition, Laxmi publishers, 2016.
2. Alan Jeffrey, "Mathematics for Engineers and Scientists", 6th Edition, Chapman & Hall/CRC publishers, 2013.
3. A R Vasisthaand R K Gupta, , "Integral transforms", Krishna prakashan publishers , 2004.
4. R.K.Jain&S.R.K.Iyenger, "Advanced Engineering Mathematics", 3rd edition, Narosa Publications, 2007.

16CH C01

CHEMICAL TECHNOLOGY

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 helps the students to understand the:

1. Concept of unit operations and unit processes in chemical process industry.
2. Flow diagrams that explain the conversion of raw materials to finished products.
3. Exposure to organic and inorganic processes.
4. Understanding process limitations and scale-up information.

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

1. Estimate the chemical industry growth and opportunities.
2. Differentiate between unit operation and unit processes.
3. Develop flowdiagrams of different processes.
4. Classify between inorganic and organic processes.
5. Design processes based on conditions, space time, yield, conversion, recycle methods, temperature, pressure.
6. Predict the process limitations and propose a model to overcome the limitations.

UNIT – I

Classification of Indian Chemical Industry, Introduction to unit operations and unit processes. Metallurgical Industry overview – classification of metals, manufacturing of pig Iron by blast furnace, methods of steel making – steel alloys. Manufacturing of copper and types of copper alloys, Manufacturing of Aluminum and types of alloys, Manufacturing of graphite and its applications.

UNIT – II

Manufacturing of H_2 by steam reforming of hydrocarbons. NH_3 Synthesis - methods and manufacturing. Urea manufacturing by total recycle.

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Manufacturing of Diammonium Phosphate. Manufacturing of Triple super Phosphate, Mixed and Bio Fertilizers.

UNIT – III

Ceramic industry overview, ceramic raw materials manufacturing of porcelain ware. Manufacturing of refractory's & applications, Cement: Raw materials, Manufacturing of Portland cement, Cement types and composition. Glass: Raw materials - Manufacturing – Types of glasses – uses.

UNIT – IV

Classification of plastics, Manufacturing of Phenol formaldehyde resin, PVC, PVA, Synthetic fibers Manufacturing of Nylon–6-6, Polyester Fiber Classification of rubbers and Manufacturing of SBR.

UNIT – V

Pulp and Paper Industry: Methods of pulping production. Recovery of chemicals from black liquor.Production of paper. Oils, Soaps, Detergents: Definitions, constituents of oils, Extraction and expression of vegetable oil. Refining and Hydrogenation of oils. Continuous process for the production of Fatty acids and Soap.

Text Books:

1. Shreve, R. N, "Chemical Process Industries", 4th Ed., McGraw Hill Book Company Inc., New York, U.S.A., 1977.
2. Rao, M. G. and Sittig, M., "Dryden's Outlines of Chemical Technology for the 21st Century, 3rdEd., Affiliated East-West Press, New Delhi, 1998.

Suggested Reading:

1. Andreas Jess and Peter Wasserscheid, "Chemical Technology: An Integral Textbook", John Wiley and Sons, Inc., New York, 2000.
2. Faith, W. L., Keys, D. B. and Clark, R. L., "Industrial Chemicals", 4th Ed., John Wiley, 1980.
3. Fertilizer Association of India, "Handbook of Fertilizer Technology", 2nd Ed.,Scientific Publisher, NewDelhi, 2009.

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16CH C02

FLUID MECHANICS

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

Course Objectives: This course helps 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. Fluidization phenomena and methods for transporting the fluids

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

1. Differentiate different types of fluids.
2. Identifyequipments 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. Apply the phenomena of fluidization applications in petroleum, chemical and allied industries.
5. Calculate the energy losses during the transport of fluids through pipes.
6. 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.

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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 -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, Drag and drag coefficient, Flow through packed beds of solids – Kozeny-Carman equation, Burke-Plummer equation and Ergun equation. Fluidization and conditions for fluidization, Minimum fluidization velocity, particulate and bubbling fluidizations, Expansion of fluidized beds, Applications of fluidization.

UNIT – V

Transportation and Metering of Fluids: Centrifugal and Positive Displacement Pumps, Characteristics of pumps, suction lift and cavitation, NPSH, Flow meters- Venturi meter, orifice meters, Pitot tube, Rota meters and Notches and Weirs, Compressors and blowers.

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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 Reading:

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.

16CH C03

MATERIAL AND ENERGY BALANCES

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

Course objectives: This course helps the students to understand the:

1. fundamental aspects of chemical engineering problem solving.
2. mass and energy balance relations for chemical processes.
3. mass balance of unit operations and processes without and with chemical reactions.
4. energy balance over different unit operations.

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

1. differentiate between mass and volume relations.
2. develop material balance equations for the processes involving unit operations.
3. write material balance equations for the process involving chemical reactions.
4. develop material balance equations for recycle and bypass operations.
5. write energy balance equations for chemical processes.
6. apply this knowledge to solve advanced chemical engineering problems.

UNIT – I

Basic concepts - Mass and volume relations, Stoichiometric and composition relations - Ideal gas law, partial pressure **-** Vaporpressures of pure components, Raoult's law and Henry's law, Vapor pressure of miscible and immiscible liquids and solutions.

UNIT – II

Material Balance Without Chemical Reaction Solubility and crystallization (single solute systems) – Material balance in Unit Operations like absorption, distillation, evaporation, crystallization, leaching, extraction, drying and mixing units under steady state conditions.

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UNIT – III

Material Balance With Chemical Reaction Material balances over units involving reactions including combustion- Proximate and ultimate analysis of coal and analysis of flue gas.

UNIT – IV

Material balances for by-pass, recycle and purge Operations.

UNIT-V

Energy Balances 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. O.A.Hougen, K.M Watson and R.A Ragatz, Chemical Process Principles, 2nd Ed, John Wiley and Sons, 2004.
2. Felder, M. Richard, Ronald, W. R., Newell, A. J., "Elementary Principles of Chemical Processes", 4th Ed., John Wiley and Sons, U.S.A., 2016.

Suggested Reading:

1. David M.Himmelbleauand James B Riqqs, Basic Principles and Calculations in Chemical Engineering", 7th Ed, PHI Learning, New Delhi, 2003.
2. K.V.Narayananand B.Lakshmikutty, Stoichiometry and Process calculations, Prentice Hall of India, New Delhi, 2006.
3. B.I Bhatt and S.B.Thakone, "Stoichiometry", 5th Ed. Tata Mc.Graw Hill, New Delhi, 2010.

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16 CY CO7

PHYSICAL CHEMISTRY

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

Course Objectives: This course helps the students to:

1. Realize the industrial importance of electro chemical processes and optimize the processes to make it industrially viable.
2. Study the effect of colligative properties of dilute solution.
3. Know the kinetics of chemical reactions.
4. Understand the effect of catalyst on a reaction.
5. Deal the properties of molecules and their structure determination using spectroscopy.
6. Appraise the students about the importance and role of physical chemistry in the field of chemical engineering.

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

1. Describe the operation of electrochemical system for the production of electric energy.
2. Apply fundamental concepts of dilute solutions to engineering problems.
3. Identify the kinetics of a reaction and offer reaction mechanisms.
4. Design a new catalytic material.
5. Operate instruments for studying the structure of chemical compounds.

UNIT I: Electrochemistry

Types of electrolytes,Specific, equivalent and molar conductance and their determinations. Laws of electrolysis and its applications. Ionic mobility, Ionic conductance and relative speed of ions – Hittorf's theoretical device. Transport number and its determination by Hittorf method. Kohlrausch's law statement and its applications - Determination of degree of dissociation of a weak electrolyte, equivalent conductance at infinite dilution for weak electrolyte and solubility products of sparingly soluble salts. Concentration cells with and without transference.

Numerical problems.

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UNIT II: Dilute Solutions

Colligative properties: Raoult's law, lowering of vapour pressure - measurement of lowering of vapour pressure by Ostwald and walker's Dynamic method. Elevation of boiling point - Determination of molecular mass from elevation of boiling point and its measurement by Cottrell's method. Depression of freezing point - Determination of molecular mass from depression of freezing point and its measurement by Beckmann's method. Osmotic pressure and its determination by using Berkeley - Hartley's method.Van'thoff theory of dilute solutions- abnormal colligative properties.

Numerical problems.

UNIT III: Chemical Kinetics

Introduction – Definition of rate, rate constant, order and molecularity. Derivation of expression for the rate constant of a first order, second order and third order reactions. Expression for half-life time of a first order, second order and third order reactions. Determination of order of reaction using integrated rate equation, half-life period and Ostwald's Isolation method. Theories of reaction rates: Effect of temperature on rate of reaction, Arrhenius equation, determination of activation energy of reaction. Collision theory of bimolecular reactions and transition state theory.

UNIT IV: Catalysis

Introduction – Definition of catalysis, positive and negative catalyst. Types of catalysis - Homogeneous and heterogeneous catalysis with examples. Characteristics of catalytic reactions.Catalytic promoters, catalytic poisoning and autocatalysis. Acid-base catalysis – Kinetics of acid – base catalyzed reactions and its mechanism. Enzyme catalysis – Mechanism and kinetics of enzyme catalyzed reaction (Michaelis – Menten equation). Factors effecting enzyme catalysis (temperature, salt concentration and pH). Characteristics of enzyme catalysis.

Numerical problems.

UNIT V:Physical properties and molecular spectroscopy

Physical properties: Additive and constitutive properties. Dipole moment– its determination and applications.Rotational spectra of diatomic molecules – principles and relationship between internuclear distance and moment of inertia.Expression for rotational energy. Criterion for absorption of radiation-selection rule and its applications.InfraRed Spectroscopy – Principles, Molecular vibrations, vibrational frequency and its applications.Atomic absorption spectroscopy- Principle, instrumentation

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(Block Diagram only) and its applications.Estimation of Nickel by Atomic absorption spectroscopy.

Numerical problems.

Text Books:

1. ArunBahl, B.S. Bahl and G.D.Tuli,, Essentials of Physical Chemistry, S.Chand & company Ltd, New Delhi 2009.

Suggested Books:

1. Puri, Sharma and Pathania , Principles of Physical Chemistry , Vishal Publishing company 2013.
2. G.M.Barrow, Physical Chemistry , McGraw Hill (2008).
3. K.L.Kapoor, A text book of Physical Chemistry , volume 1, 2, 3 & 4 Macmillan 2001.
4. T. Navneeth Rao, Problems in Physical Chemistry, Macmillan India Ltd., Hyderabad 2001.

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16MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

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

Course Objectives: TheObjectives of the course are:

1. to introduce managerial economics and demonstrate its importance in managerial decision making.
2. to develop an understanding of demand and relevance of its forecasting in the business.
3. to provide the basics of market structure and the concept of equilibrium in different market structures.
4. to examine the economic analysis of production process, types of inputs and to explain different costs and their relationship with the output.
5. to understand the importance of project evaluation in achieving a firm's objective.
6. to explain the concept of Accountancy and provided knowledge on preparation and analysis of Final accounts.

Course Outcomes: After completion of the 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. understand price determination for different markets.
4. study production theory and analyze various costs & benefits involved in it so as to make best use of resources available.
5. analyze different opportunities and come out with best feasible capital investment decisions.
6. apply accountancy concepts and conventions, Final accounts and financial analysis.

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UNIT-I:Introduction to Managerial Economics

Introduction to Economics and its evolution - Managerial Economics -its scope, importance, Its usefulnesstoengineers-Basicconceptsof Managerial economics.

UNIT-II: DemandAnalysis

DemandAnalysis- concept of demand, determinants, Law of demand, its assumptions, Elasticity of demand, price, income and cross elasticity, Demand Forecasting – Types of Market structures. (Simple numerical problems).

UNIT-III: Production and Cost Analysis

Theoryof Production-Firm and Industry-Production function-input-out relations- laws of returns - internal and external economies of scale. Cost Analysis: Cost concepts - fixed and variable costs -explicit and implicit costs-out of pocket costs and imputed costs - Opportunity cost - Cost output relationship - Break- even analysis. (Theory and problems).

UNIT-IV: Accountancy

Book-keeping, principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments.

UNIT-V: Capital Budgeting

Introduction to capital budgeting, Methods: traditional and discounted cash flow methods. Introduction to Working capital management. (Numericalproblems).

Text Books:

1. MehtaP.L.,"Managerial Economics–Analysis, Problems and Cases", Sultan Chand & Son'sEducational publishers, 2013.
2. MaheswariS.N. "Introduction to Accountancy", Vikas Publishing House, 2013.
3. Panday I.M. "Financial Management", Vikas Publishing House, 11th edition, 2015.

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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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16CH C04

CHEMICAL TECHNOLOGY LAB

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

LIST OF EXPERIMENTS

(Minimumof**EIGHT** experiments in the list is to be performed selecting at least **FOUR**from each cycle.)

Cycle –I

1. Analysis of Iron Ore.
2. Analysis of Copper Ore.
3. Estimation of Borax.
4. Estimation of carbonates and bicarbonates ions.
5. Estimation of Dissolved Oxygen in Water.
6. Estimation of Chlorine in Water Sample.
7. Estimation of Calcium Ions in Natural Water.

Cycle – II

1. Estimation of Urea.
2. Estimation of Acid Value of oils.
3. Estimation of Formaldehyde in formalin solution.
4. Estimation of Glucose.
5. Preparation of Nitro-benzene.
6. Preparation of Meta dinitro benzene.
7. Preparation ofAcetanilide.

Text Books:

1. Harris, C. H., “Quantitative chemical analysis”, 7th Ed., W. H. Freeman, New York, 2006.
2. Willard, H. H.,andMeritt, L. L., “Instrumental methods of Analysis”, 7th Ed., ACS Publications, 1989.

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Suggested Reading:

1. Skoog, A. D., Holler, F. J., Stanley, R. C., "Principles of Instrumental Analysis", 7th Ed., Brookes Cole, 1997.
2. S.K.Bhasin and Sudha Rani, "Laboratory manual in engineering chemistry", Dhanpathrai Pub. Company, 2009.

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16CY C08

PHYSICAL CHEMISTRY LAB

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

Course Objectives: This course helps the students to:

1. Give hands on experience in application of theoretical concepts in experimentation.
2. Develop laboratory skills and ability to work independently.
3. Deepen the student's understanding of the principles of spectroscopy, electro chemistry and kinetics through experimentation.
4. Analyze the materials and estimate various metals.
5. Use various instruments in analytical methods.

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

1. Analyze the efficient management of any industrial processes.
2. Ability to understand, explain and select instrumental techniques for analysis.
3. Demonstrate chemical and analytical methods.
4. Apply chemical principles in science and technology as well as on multidisciplinary designteams.
5. Ability to analyze and interpret the experimental data.
6. Gain ability in handling experiments and design new experiments.

List of Experiments

(Minimum of 08 experiments in the list are to be performed)

1. Determination of order of the reaction of hydrolysis of methyl acetate in dilute hydrochloric acid.
2. Determination of order of the reaction between potassium persulphate and potassium iodide.
3. Determination of distribution coefficient of I_2 between CCl_4 and water.
4. Determination of distribution coefficient of benzoic acid between water and toluene.

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5. Estimation of amount of HCl and CH_3COOH present in the mixture of acids conductometrically using NaOH solution.
6. Verification of Ostwald's dilution law by determining the dissociation constant of a weak acid Conductometrically.
7. Potentiometric redox titration between Fe^{2+} and $K_2Cr_2O_7$.
8. Potentiometric precipitation titration between KCl and $AgNO_3$.
9. Verification of Beer-Lambert's Law for $CuSO_4$ solution colorimetrically.
10. Estimation of Fe (III) using Potassium thiocyanate solution colorimetrically.
11. Estimation of amount of HCl and CH_3COOH present in the mixture of acids pH metrically using NaOH solution.
12. Determination of pKa of a weak acid pH metrically.

Text Books:

1. B.D.Khosla, V.C. Garg and AdarshKhosla , Senior practical physical chemistry, R.Chand& company, New Delhi (2012).

Suggested Books:

1. J.Mendham and Thomas , Vogel's text book of quantitative chemical analysis, Pearson Education Pvt. Ltd. New Delhi, 6th edition. (2002).
2. S.K.Bhasin and SudhaRani , Laboratory manual in engineering chemistry, Dhanpathrai Publishing Company (2008).
3. MERITT & WILLARD, Instrumental methods of Chemical Analysis, East-West Press (2001).

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16ME C13/16EE C05

BASICS OF MECHANICAL AND ELECTRICAL ENGINEERING LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

MECHANICAL ENGINEERING LAB

Course Objectives: Student will be able to

1. acquire knowledge in evaluating material characterization and the performance of I.C. Engines.
2. demonstrate this knowledge in tuning of simple components.
3. distinguish between various manufacturing processes.

Course Outcomes: students are able to

1. Evaluate the properties of material by tensile testing and performance of diesel engine.
2. Produce the parts by simple turning process.
3. Understand the concepts of welding, casting (moulding) process.

List of Experiments:

1. To characterize the material by simple tensile testing using UTM.
2. To conduct performance test on four-Stroke single cylinder Diesel Engine.
3. Practice on simple turning on Lathe machine.
4. Moulding practice for simple patterns.
5. Making a straight bead with arc welding.

ELECTRICAL ENGINEERING LAB

Course Objectives:

1. To acquire the knowledge of different types of electrical elements.
2. To verify the basic electrical circuit laws.
3. To determine the parameters and power factor of a coil.

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Course Outcomes: The student will be able to

1. Find out the resistance of the given resistor.
2. Understand the voltage division and current division rules.
3. Determine the parameters of the given coil.
4. Measure the power factor of a coil using different methods.

LIST OF EXPERIMENTS

1. Study of different types of resistors, inductors and capacitors.
2. Verification of Ohm's law.
3. Verification of KVL & KCL.
4. Verification of Voltage and current division rules.
5. Measurement of power factor of a coil using 3 ammeters.
6. Measurement of power factor of a coil using 3 volt meters.
7. Determination of the parameters of a coil.

Note: At least **FOUR** Experiments should be conducted in the semester.

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Choice Based Credit System
B.Tech (Chemical Engineering)

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	16CH C05	Chemical Engineering Thermodynamics - I	3	-	3	30	70	3
2	16CH C06	Chemical Reaction Engineers - I	3	-	3	30	70	3
3	16CH C07	Material Science for Chemical Engineers	3	-	3	30	70	3
4	16CH C08	Mechanical Unit Operations	3/1	-	3	30	70	4
5	16CH C09	Process Heat Transfer	3/1	-	3	30	70	4
6	---	**Elective - I**	3	-	3	30	70	3
PRACTICALS								
7	16CH C10	Fluid Mechanics Lab	-	3	3	25	50	2
8	16MT C07	Programming Laboratory for Numerical Methods	-	2	2	15	35	1
9	16EG C03	Soft Skills and Employability Enhancement Lab	-	2	2	15	35	1
		Total	**20**	**7**	**-**	**235**	**540**	**24**

S.No.	Elective-I Course Code	Title of Elective-I Course (Inter Disciplinary and program specific Elective options)
1.	16CY E01	Advanced Organic Chemistry
2.	16MT E01	Numerical Techniques and Statistical Methods
3.	16CH E01	Fertilizer Technology

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

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AssessmentProcedures for Awarding Marks

The distribution of marks is based on CIE by concerned teacher and the Semester end examination shall be as follows:

Course (in terms of credits)	CIE	Semester end Examination(Marks)	Remarks	Duration of SemesterEnd Examination
Three(3) Credits/ Four(4) Credits	30*	70**	Theory Course/ Engg.Graphics	3 Hours
Two(2) Credits	20*	50***	Theory	2 Hours
Two(2) Credits	25	50	Lab Course/ Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
Two(2) Credits	50	—-	Project Seminar/ Seminar	——
Six(6) Credits	50	100	Project	Viva-Voce
One(1) Credit	—-	50***	Environmental Studies,Profess-ional Ethics and Human values	2 Hours
One(1) Credit	50		Mini Project	——-

CIE: Continuous Internal Evaluation

*Out of 30/20 sessional marks(CIE), 10/5 marks are allotted for slip-tests (Three slips test will be conducted, each of 10/5 marks, best two average is considered) and the remaining 20/15 marks are based on the average of two tests, weightage for each test is 20/15 marks.

**The question paper will be in two parts, Part-A and Part-B. Part A is for Ten(10) questions and is compulsory, covers 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).

***The question paper will be in two parts, Part-A and Part-B. Part A is for Ten(10) questions and is compulsory, covers the entire syllabus, and carries 15 marks. Part-B carries 35 marks and covers all the units of the syllabus (student has to answer five out of seven questions).

Note: A course that has CIE (sessional marks) but no semester end examination 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 for theory course is 40% of total marks i.e., CIE plus semester end examinations whereas for the lab course/project is 50%.

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16CH C05

CHEMICAL ENGINEERING THERMODYNAMICS – I

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

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.

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

1 use the fundamentals and differentiate between relations of measurable nature of P, V, T and the un-measurable nature of H, U, A, G.

2 estimate thermodynamic properties of real gases using equations of state, correlations and tables.

3 analyze processes involving ideal gases, such as isothermal, isobaric, isentropic, cyclic.

4 reiterate the first and second laws of thermodynamics and apply their practical implications in engineering design.

5 apply energy balances to open and closed systems and to evaluate the thermodynamic efficiency of nozzles, compressors, turbines.

6 analyze steam power cycles; refrigeration cycles and liquefaction and calculate relevant system efficiencies for the processes.

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

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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, 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; 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,refrigeration and Liquefaction, 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; Adiabatic and isothermal flow of compressible fluids through pipes of constant cross-section with and without friction; expansion process involving flow through nozzles and turbines, throttling process; compression processes - compressors and pumps; calculation of ideal work and lost work for flow processes.

Text Books:

1. Octave Levenspiel, “Chemical Reaction Engineering”, 3rd Ed, Wiley India Pvt.Ltd, New Delhi, 2006.
2. H.ScottFogler, “Elements of Chemical Reaction Engineering”, 3rd Ed., Prentice Hall Pvt. Ltd., New Delhi, 2002.

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Suggested Reading:

1. J.M. Smith, “Chemical Engineering Kinetics”, 3rd Ed., McGraw-Hill,New York, 1981.
2. K.A.Gavhane, “”Chemical Reaction Engineering-1",NiraliPrakashan Publishers, Pune, India, 2011.

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16CH C06

CHEMICAL REACTION ENGINEERING – I

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

Course Objectives: This course helps the students to understand the:

1. Classification of reactions, rates and forms of rate expressions.
2. Procedure to interpret the data relating moles, concentration, extent of reaction and conversion.
3. Experimental kinetic data and reaction mechanisms andconcepts of non-ideal reactors.
4. Factors to choose applicable reactor among single, multiple, recycle reactors etc.

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

1. Derive performance equations of batch, and continuous reactors from general material balances.
2. Analyse reactor performance for homogeneous and heterogeneous reactions.
3. Apply the concepts of heat effects on reactions.
4. analyse multiple reactions.
5. Designdifferent types of chemical reactors for batch and continuous operation like CSTR and Tubular.
6. Determinereactor behavior for non-ideal flow.

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 ’! rR+sS. Single and multiple reactions, Elementary and non-Elementary reactions, Molecularity and order of Reaction, Specific reaction rate constant, Testing kinetic models – Steady

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state approximation, Equilibrium treatment, Fitting a rate law for the given reaction mechanism, predictability of reaction rate from theory. Temperature dependency from Arrhenius' law, Collision theory and Transition state theory.

UNIT – II

Interpretation of Batch Reactor 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.

UNTI – III

Reactor Design: Introduction, Ideal Reactors for a Single Reaction, Space time – space velocity, Steady state mixed flow reactor, Steady state plug flow reactor, Holding time and space time for flow reactors. 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: Introduction to multiple reactions, Qualitative discussion about product distribution for Parallel, Series and Series-parallel reactions. Quantitative treatment of product distribution and of reactor size for irreversible simple reactions of parallel, and Series only. 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.

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UNIT – V

Non-Ideal flow: Basics, 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 behaviour. Exit age distribution of fluid, Experimental methods for finding E – pulse, step experiments, Relationship between F and E curves. The convolution integral.Conversion in non- ideal flow reactors.

Text Books:

1. Octave Levenspiel, "Chemical Reaction Engineering", 3rd Ed, Wiley India Pvt.Ltd, New Delhi, 2006.
2. H.ScottFogler, "Elements of Chemical Reaction Engineering", 3rd Ed., Prentice Hall Pvt. Ltd., New Delhi, 2002.

Suggested Reading:

1. J.M. Smith, "Chemical Engineering Kinetics", 3rd Ed., McGraw-Hill,New York, , 1981.
2. K.A.Gavhane, "Chemical Reaction Engineering-1", Nirali Prakashan Publishers, Pune, India, 2011.

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16CH C07

MATERIAL SCIENCE FOR CHEMICAL ENGINEERS

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

Course Objectives: This course helps the students to understand the:

1. criteria involved in identifying materials for chemical engineers.
2. concept of phase-transformations that occur during material manufacture and vis-à-vis the effect on properties.
3. significance of different properties for selecting material under different combinations of process conditions.
4. possible and latest alternatives available for standard engineering materials.

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

1. apply the basic fundamentals of engineering for material selection.
2. developTime–Temperature–Transformation (T-T-T) relations of materials.
3. apply phase equilibrium diagrams for heat treatment of steels.
4. select the right materials for design and fabrication of process equipment.
5. select materials for high and low temperature applications.
6. identify new or alternate materials for development and operation of process industry.

UNIT – I

Introduction to Engineering Materials: Classification – metals, non-metals, alloys; Introduction to metallic materials: Ferrous metals and alloys – Iron and steel, types of steels like mild steel, carbon steel and stainless steel, Common grades of steel (304, 316); Non-Ferrous metals and alloys of Aluminum, Copper and Nickel; Introduction to non-metallic materials: Polymers, Ceramics, Refractories and Composites; Criteria for material selection.

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UNIT – II

Phase Diagrams: Phase rule, Definition and construction of phase diagrams, Basic types of binary phase diagrams: Cu-Au, Al-Si, Al-Cu, Mg-Sn, Cu-Zn. Iron-Iron carbide equilibrium diagram. Applications of Phase Equilibrium Diagrams: Time–Temperature–Transformation (T-T-T) relations of steels, Zone refining, Heat treatment of steels.

UNIT – III

General Properties of Engineering Materials: Mechanical Properties: Stress-strain diagram, Elastic, Plastic, Anelastic and Viscoelastic behavior, Hardness, testing, Deformation – hot and cold working, 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 fibers. Magnetic Behavior: Magnetism, Susceptibility, Anisotropy and Hysteresis, Ferro-, Para, -and Dia- Magnetism soft and hard magnetic materials.

UNIT – IV

Materials for High and Low Temperature Applications: Ceramics and Refractories – Classification, advantages, general properties and engineering applications. Introduction to Superalloys.Electrical Materials– Different types like conductors, semiconductors and superconductors; general properties and engineering applications. Polymers and Elastomers – Classification, advantages, general properties and engineering applications.

UNIT–V

New Materials: Composite materials - Classification, advantages over alloys, general properties and applications. Nano-materials: Introduction, carbon nanotubes, nanosensors. Biomaterials: Need of ceramics, Interaction with bioenvironment, Biocompatibility, Types of biomaterials - Nearly inert ceramics, surface active ceramics, resorbable ceramics.

Text Books:

1. Raghavan, V., "Elements of Materials Science and Engineering- A first course", 5th Ed, PHI learning pvt.ltd., 2006.
2. Rajput, R. K., A Textbook of Material Science and Engineering, 2nd ed., S.K.Kataria and Sons, 2013.

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Suggested Reading:

1. Callister, W. D., “Materials Science and Engineering”, 5th Ed, John Wiley and Sons. Inc., 2002.
2. Krishan K. Chawla, “Composite Materials: Science and Engineering”, Springer-Science Media, USA, 1987.

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16CH C08

MECHANICAL UNIT OPERATIONS

Instruction	3+1 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives: This course helps the students to understand the:
1. principles of size reduction using various equipments.
2. techniques for separating solids based on size by different methods.
3. different kinds of filtration units.
4. various aspects of Mixing and Agitation of solids and liquids.

Course Outcomes: At the end of the course, the students will be able to:
1. decide the transport of solids based on their properties.
2. select equipment for industrial application with respect to size reduction.
3. design equipment for industrial application with respect to separation of solids.
4. decide the necessary equipment to screen different particles based on their properties.
5. Apply the different filtration techniques for industrial application.
6. identify the suitable technique for blends and mixing of liquids and solids.

UNIT – I

Particle Technology: Characteristics of solid particles – screen analysis, Differential and cumulative mean diameters for mixture of particles, properties of particulate masses. Handling and transport of solids, storage equipment for mechanical conveyors and elevators, pneumatic transport.Communition – principles of Communition laws and energy requirements. Size reduction - Description and working of crushing and grinding equipment – jaw, Gyratory and Roll crusher, Hammer mill, Rod mill and Ball mill, Ultra fine grinders. Cutting machines – Open and closed circuit grinding.

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UNIT – II

Size separation: Industrial screening equipment – Grizzlies, Tromels and gyratory. Capacity and effectiveness of screen.Flotation, Frothing and dispersing agents' magnetic separation, electrostatic precipitators. Particle dynamics: Principles of motion of particles through fluids, drag coefficient for spheres, motion of spherical particles. Free and hindered settling.Classifiers, jigging.Sorting classifiers – Heavy medium and differential settling methods.Principle and working of cyclones and hydro cyclones.

UNIT – III

Solid-liquid separation operations: Flocculation – Batch sedimentation – Thickeners – Thickener design. Principles of centrifugal sedimentation – Centrifugal classifiers and decanters – tubular, disc, bowl and scroll centrifuges.

UNIT – IV

Filtration:Equations for batch filtration. Description of plate and frame filter press, shell and leaf filters. Rotary vacuum drum filters. Membrane filtration, Centrifugal filters. Filter aids, Theory of constant rate and centrifugal filtration.

UNIT – V

Mixing and Agitation: Agitation equipment for liquids – Circulation velocities and power consumption in agitated vessels. Scale up of agitation equipment – Equipment for blending and mixing of liquids – Suspension of solid particles. Critical speed – Dispersion of gas in liquids.Gas holdup and power requirement.Dispersion of liquids in liquids.Equipment for mixing of solids and pastes – Mixers for dry powders – mixing index.

Text Books:

1. W. L. McCabe, J. C. Smith and P.Harriott , Unit Operations of Chemical Engineering, 7thEd., Tata-McGraw Hill Chemical Engineering Series, New Delhi, 2005.
2. Foust A.S, Wenzel L.A., "Principles of Unit Operations", 2nd Ed., John Wiley and sons, NewYork, 1981.

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Suggested Reading:

1. Coulson, J. M., and Richardson, J. F., "Chemical Engineering Series", Vol. 2, 4th Ed., Pergamon Press Oxford, UK, 1991.
2. C M Narayanan and B C Bhattacharya, "Mechanical Unit Operation for Chemical Engineering", Khanna Publishers, 3rd Ed, 2011.

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16CH C09

PROCESS HEAT TRANSFER

Instruction	3+1 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives: This course helps the students to understand the:

1. overall view of different modes of heat transfer applicable to process industries.
2. heat transfer to fluids without and with phase change.
3. concept and functioning of different heat exchangers.
4. Fundamentals of heat transfer by conduction, convection and radiation.

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

1. Distinguish between different types of heat transfer
2. Analyze the concepts of heat exchanger
3. Calculatethe rate of heat transfer with and without change of phase.
4. Decide the type of evaporator required for a specific purpose.
5. Identify the effect of combined heat transfer by conduction, convection and radiation.

UNIT - I

Modes of Heat Transfer – derivation of heat conduction equation in rectangular co-ordinates – one dimensional heat conduction without heat generation through plane, cylindrical and spherical walls – Resistance concept - situations involving conduction and convection – critical and optimum insulation thickness – Numerical problems on unsteady heat conduction through semi-infinite slab, infinite slab and cylinder – lumped capacity systems.

UNIT - II

Heat Transfer to Fluids Without Phase Change – forced convection in laminar flow over plates and in tubes – dimensional analysis. Correlations for heat transfer in turbulent flow, natural convection, Agitated vessels,

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packed beds – Analogy between heat and momentum transfer – Reynolds, Prandtl and Colburn analogies.

UNIT - III

Heat Transfer to Fluids With Phase Change – heat transfer from condensing vapors – Drop wise and Film wise condensation – Derivation and practical uses of Nusselt equation. Boiling of saturated liquid – maximum heat flux and critical temperature drop, minimum flux and film boiling. Typical heat exchange equipment – counter and parallel flows,

energy balances, log-mean temperature difference and correction for mixed and cross flow – Rating of single and multiple heat exchangers – Description of extended surface heat exchangers.

UNIT - IV

Evaporators - Types– capacity and economy of evaporators – material and energy balances in evaporation – multiple effect evaporation and methods of feeding – Barometric leg, steam traps – heat transfer coefficients in evaporators – Description and working of crystallizers.

UNIT - V

Radiation - Fundamentals of radiation heat transfer, laws of black body radiation, radiating heat exchange between non-black surfaces, combined heat transfer by conduction, convection and radiation, radiation shields.

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. Donald Q.Kern, “Process Heat Transfer”, 1st Ed., McGraw-Hill publishers, New York, 2001.

Suggested Reading:

1. Hollman, J.P., “Heat Transfer”, 10th Ed., McGraw-Hill publishers, 2011.
2. Coulson, J. M., and Richardson, J. F., “Chemical Engineering Series”, Vol. 1, 4th Ed., Pergamon Press Oxford, UK, 1991.
3. B.K.Dutta, “Heat Transfer Principles and applications”, PHI learning Pvt. Ltd.,New Delhi, 2004.

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16CY E01

ADVANCED ORGANIC CHEMISTRY

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

Course Objectives: This course helps the student to

1. impart knowledge of organic chemistry to chemical engineering students.
2. learn nomenclature and isomerism of organic molecules in a better way which forms the basis of our life.
3. gain knowledge in designing new synthetic processes.
4. learn various separation techniques useful for research purpose.
5. learn the latest techniques of instrumental analysis.

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

1. identify organic functional groups using chemical processes.
2. classify the types of isomerism in various organic molecules.
3. illustrate the mechanism of a reaction using oxidizing and reducing agents.
4. design separation techniques commonly used in research industries.
5. analyze the molecules using data from spectroscopic techniques.

UNIT I:

Nomenclature and functional groups

Review of nomenclature of organic compounds. IUPAC system.Chemical reactions (without mechanism) of a) Alcohols – with HX, H_2SO_4, heating/ H+, oxidation and reduction. b) Ethers – with HX c) Carbonyl compounds (aldehydes/Ketones) – with RMgX, NH_3 and its derivatives, oxidation (with $KMnO_4$), reduction (with ZnHg/HCl), hydrazine) d) Carboxylic acids – acidic character, PCl_5, $SOCl_2$, NH_3, esterification, oxidation and reduction e) Amines – basic character, carbylamine reaction, acetylation (difference between 1°, 2° and 3° amines) and diazotization.

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UNIT II:

Isomerism and Stereochemistry

Definition of isomerism.Types of isomerism – structural and stereoisomerism.Structural isomerism with examples (chain, positional, functional isomerism and tautomerism). Stereoisomerism conformational and configurational isomerism (Newmann projection formula) – definition, n-butane as example. Geometrical isomerism – cis/trans or E/Z isomerism with one example each. Optical isomerism – Introduction to optical activity, plane polarized light, causes of optical activity. Optical activity in compounds containing one asymmetric (lactic acid) and two similar (tartaric acid).Enantiomers and Diastereomers – definition.Relative (DL) and absolute (RS) configuration of simple molecules like glyceraldehyde, glyceric acid, sec-butyl alcohol. Sequence rules.

UNIT III:

Named reagents and reactions in organic synthesis

Reagents in organic synthesis – Introduction, oxidizing reagents: potassium permanganate (with 2-butene), potassium dichromate (with 1°,2° alcohols) and lead tetraacetate (with 1,2 diol) with mechanism. Reducing reagents: reagents in catalytic reactions – H_2/Pd (to reduce alkenes and alkynes) with any two examples; reagents in chemical reactions – $LiAlH_4$, $NaBH_4$ with two examples (without mechanism). Named reactions – Aldol condensation, Hoffmann degradation and Perkin reaction with mechanism and example.

UNIT IV:

Chromatographic techniques

Introduction – Types of chromatography, TLC and column – principles, processes and applications. HPLC – principle and application.

UNIT V :

Spectroscopic analysis of organic compounds.

IR spectroscopy: Instrumentation, application of IR spectroscopy for identification of organic molecules containing – OH,-NH2,>C=O, -C ≡C-, -CN, phenyl, -C-O-C-, $-CONH_2$, -COOH and –COOR.UV spectroscopy: Basic principles, types of excitation, bathochromic and hypsochromic shift, Instrumentation. Application to simple molecules (1,3-butadiene, stilbene and benzaldehyde).

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Text Books:

1. R.T.Morrison and R.N.Boyd ,Organic chemistry, 6th edition, Prentice Hall, New Delhi, 1999.
2. Y.R.Sharma, Elementary organic spectroscopy , 5th edition , S. Chand and Co., 2013.

Suggested Books:

1. G.L. David Krupadanam, Analytical chemistry, Orient Longman, A.P., 2004.
2. T. W. Graham Solomons, Organic chemistry, 6th edition, 2007.
3. William Kemp, Organic spectroscopy, 3rd edition, Palgrave, New York, 2005.

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16MT E01

NUMERICAL TECHNIQUES AND STATISTICAL METHODS

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

Course Objectives: This course helps the students to understand the:

1. To find the roots of the non-linear equation using the different methods.
2. To identify the solution for Initial Value Problem using numerical techniques.
3. To estimate the statistical averages/ensemble averages of the probability functions.
4. Probability distributions for random phenomenon of the physical data.
5. Statistical hypothesis and assumptions for testing the data.

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

1. Solve the non-linear equations for generating the roots.
2. Solve the first order ordinary differential equations using numerical techniques.
3. Analyse the probability function with the help of statistical averages.
4. Fit the probability distribution (discrete and continuous) for the random phenomenon.
5. Formulate the statistical hypothesis for the statistical data.
6. Interpret the random behaviour of physical data.

UNIT – I

Solution of linear and non-linear equations: Numerical Solution of linear simultaneous equations by Gauss-elimination direct method, Gauss-Jordan direct method, Gauss-Seidel iteration method. Solution of Transcendental (non-linear) equations by Bisection method, Regula-Falsi method and Newton-Raphson method.

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UNIT – II

Numerical solutions of ordinary differential equations: Numerical solutions of ordinary differential equations by Euler's Method, modified Euler's method, Taylor's method and Runge-Kutta fourth order method.

UNIT – III

Random variables: Mathematical Expectation, Variance, Co-Variance, and its properties, Probability function, Moments, moment generating function, cumulative generating function and its properties.

UNIT – IV

Probability Distribution: Discrete distribution: Binomial, Poisson distributions, finding Mean and Variance through moment generating function. Continuous distribution: Normal distribution and Exponential distributions.

UNIT – V

Testing of Hypothesis: Null and alternative Hypothesis, Types of errors, Level of significance, testing the single mean (small).Testing the chi-square, Goodness of fit for independents of attributes, equality of population variances.

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2015.
2. M.K.Jain, S.R.K Iyengar and R.K.Jain: Numerical methods for Scientific and Engineering Computation. New Age International publications, 2008.
3. S.C Gupta and V.K.Kapoor, "Fundamentals of Mathematical statistics", S.Chand and Co Publishers, 2006.

Suggested Reading:

1. N P Bali, Manish Goyal, "A Text Book of Engineering Mathematics", 9th Edition, Laxmi publishers, 2016.
2. Kanti B. Datta, "Mathematical Methods of Science and Engineering", CENGAGE Learning publishers, 2014.
3. Miller and Freund, "Probability and Statistics for Engineers", Pearson publishers, 2005.
4. S.S.Shastry, "Introductory Methods of Numerical Analysis", 5th Ed, EEE publishers, 2014.

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16CH E01

FERTILIZER TECHNOLOGY

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

Course objectives: This course helps the students to understand the:

1. Use of fertilizers in improving soil productivity and crop yield.
2. Different types of the nitrogenous, phosphatic and potash fertilizers.
3. Various fertilizer application methods.
4. Different organic fertilizer production methods.

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

1. Identify the different nutrients and significance of feed stocks for the production of fertilizers.
2. Identify methods for the production of various nitrogenous fertilizers.
3. Apply different manufacture methods for various phosphorous fertilizers.
4. Production methods for potassium and mixed complex fertilizers
5. Differentiate the need, application techniques and uses of new variety of fertilizers.
6. Design effluent treatment methods and impact of fertilizers on environment.

UNIT – I:

Introduction: Fertilizer Technology, Plant Nutrients, Role of essential elements for plant growth. Availability of feed stocks.Nitrogen Fertilizers - Feed stocks for the production of Ammonia, Ammoniasynthesisby – Haber and Kellogg processes.By-productammonia recovery by direct and indirect methods.

UNIT –II

Manufactureof Urea: Manufacture of urea and othernitrogenous fertilizerssuchas ammoniumsulfate, ammonium nitrate, calciumammoniumnitrate, ammoniumchloride. Manufacture of nitric acid.

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UNIT – III

Phosphorous fertilizers: manufacture of single and triple super phosphate. Production of ammoniumphosphates – mono-, Di- and nitro-phosphates, Manufacture of phosphoric acid by wet process and thermal process.

UNIT –IV

Introduction to new variety of fertilizers: Potassium fertilizers, mixed and NPK fertilizers.Liquid fertilizers.Bio fertilizers – introduction, advantages over chemical fertilizers, types and uses.

UNIT –V

Fertilizer application techniques: different soil controlled release fertilizers. Effluent treatment methods for various fertilizer plants.Environmental impact of fertilizer plants on Ecosystem. IndianFertilizer industry – production Economics and future plans.

Text Books:

1. Brahma Mishra, "Fertilizer Technology and Management", IK International Publishing House Pvt. Ltd., New Delhi, 2012.
2. Dr. ShaliniSuri, "BioFertilizers and Biopesticides", 1st Ed., APH publishing Corporation, New Delhi, 2011.

Suggested Reading :

1. Fertilizer Association of India, "Fertilizer Handbook", 2nd Ed., Scientific Publisher, New Delhi, 2009.
2. UNIDO, "Fertilizer Manual", 3rd edition, Kluwer Academic Publishers, New Delhi,1998.

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16CH C10

FLUID MECHANICS LAB

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

LIST OF EXPERIMENTS

Note:Minimumof**EIGHT** experiments are to be performed.

1. Determination of discharge coefficient of orifice meter and Venturimeter and their variation with Reynold's number.
2. a) Determination of weir meter constant K for V-notch and rectangular notch.

   b) Calibration of rotameter and study of variation of flow rate with tube to float diameter.
3. Determination of viscosity of Glycerol – water solution at different temperatures.
4. Determination of friction factor for flow of water through annulus using Fanning's and Darcy's equations.
5. Determination of friction factor for flow through straight pipes of different diameters and study of variation of friction factor with Reynolds number.
6. Determination of friction losses in pipe fittings.
7. Determination of clearance volume and efficiency of an air compressor.
8. Determination of characteristic curves for centrifugal pumps.
9. a) Determination of friction factor for packed beds.

   b) Determination of minimum fluidization velocity.
10. Determination of pressure drop through helical coils.
11. Determination of velocity profile of air in pipe by pitot tube.
12. Determination of critical velocity by Reynolds Experiments.

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Text Books:

1. C.J.Geankopolis, “Transport processes and unit operations”, 3rd Ed., Prentice Hall Publishers, USA, 1993.
2. BireswarMajumdar, “Fluid Mechanics with laboratory manual”, PHI Learning Pvt. Ltd., New Delhi, 2011.

Suggested Reading:

1. Gupta, V. P., “Laboratory manual of Fluid Mechanics and Machines” 3rd Ed., CBS Publishers, New Delhi, 2011.

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16 MT C07

PROGRAMMING LABORATORY FOR NUMERICAL METHODS

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

LIST OF EXERCISES

CYCLE – I: Introduction to MATLAB programming techniques

1. Introduction to 'MATLAB Programming technique'.
2. MATLAB code writing - variables, operators, arrays, loops.
3. MATLAB code writing- functions, input/output statements, plotting.
4. Writing and running programs - learning the 'Built-in functions' in MATLAB software useful for problem solving.

CYCLE – II: Application of MATLAB Programming

5. Numerical Solution of linear simultaneous equations by direct methods:
   i. Gauss-elimination direct method.
   ii. Gauss-Jordan direct method.
6. Numerical Solution of linear simultaneous equations by indirect methods:
   i. Jacobi method.
   ii. Gauss-Seidel indirect method.
7. Solution of non-linear equations by:
   i. Bisection method.
   ii. Newton-Raphson method.
8. Numerical solutions of ordinary differential equations by:
   i. Euler's Method.
   ii. Runge-Kutta fourth order method.
9. Interpolation and Curve fitting by Linear Least square analysis.
10. Interpolation and Curve fitting by Non-linear Least square analysis.

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Textbooks:

1. RudraPrathap, “Getting Started with MATLAB: A quick Introduction for Scientists and Engineers”, New York, Oxford University Press, 2010.
2. B. S. Grewal, “Numerical Methods in Engineering & Science with programs in C, C++ and MATLAB”, Khanna Publishers, 2014.
3. JaanKiusalaas, “Numerical Methods in Engineering with MATLAB”, Cambridge University Press, U.S.A., 2005.

Suggested Reading:

1. M. K. Jain, S. R. K. Iyengar and R. K. Jain, “Numerical methods for Scientific and Engineering Computation”,
   New Age International publications, 2008.
2. DukkipatiRao.V, “Applied Numerical Methods using MATLAB”, New Age International (P) Ltd. Publishers,
   New Delhi, 2011.
3. Timmy Siauw and Alexander Bayen, “An Introduction to MATLAB Programming and Numerical Methods for Engineers”, 1st Ed., Elsevier Publications, Academic Press, USA, 2014.

16EG CO3

SOFT SKILLS AND EMPLOYABILITY ENHANCEMENT 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: To help the students

1. Participate in group discussions and case studies with confidence and to make effective presentations. Also to learn the art of communication.
2. With- resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management & goal setting, self-confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.
5. To understand the elements of research and hone their soft skills through a live, mini project.

Course Outcomes: The 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

Group Discussion and Case studies: Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

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Elements of effective presentation, Structure of presentation, Presentation tools, Body language,

Creating an effective PPT.

Exercise 2

Interview Skills: Resume writing, structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets.

Interview Skills: concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews.

Exercise 3

Personality Development: Effective Time Management, setting realistic goals, self-confidence and assertiveness, stress management, moral values.

Exercise 4

Corporate Culture: Grooming and etiquette, communication media etiquette,

Academic ethics and integrity.

Exercise 5

Mini Project: General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar.

Suggested Reading:

1. Dr. ShainiVerma, "Body Language- Your Success Mantra", S Chand, 2006 .
2. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010.
3. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
CHEMICAL ENGINEERING
B.Tech III – Year

I – Semester

THEORY						
S. No	**Code**	**Subject**	**L**	**T**	**P**	**Credits**
1	CH 311	Chemical Reaction Engineering - II	4	0	0	3
2	CH 312	Mass Transfer Operations - I	4	0	0	3
3	CH 313	Process Dynamics and Control	4	0	0	3
4	CH 314	Process Heat Transfer	4	0	0	3
5	CH 315	Process Instrumentation	4	0	0	3
6	CE 444	Human Values and Professional Ethics	2*	0	0	0
PRACTICALS						
7	CH 316	Chemical Reaction Engineering Lab	0	0	3	2
8	CH 317	Process Heat Transfer Lab	0	0	3	2
9	EG 221	Soft Skills and Employability Enhancement	0	0	2	1
TOTAL			**22**	**00**	**08**	**20**

L: Lecture, T: Tutorial, D: Drawing, P: Practical
* 21 periods per semester

II – Semester

THEORY						
S. No	**Code**	**Subject**	**L**	**T**	**P**	**Credits**
1	CH 321	Bio-Chemical Engineering	4	0	0	3
2	CH 322	Chemical Engineering Thermodynamics - II	4	0	0	3
3	CH 323	Energy Engineering	4	0	0	3
4	CH 324	Process Modeling Simulation And Optimization	4	0	0	3
5	CH 351 CH 352	**Elective - I** Surface Coatings Technology Technology of Vegetable oils and Fats	4	0	0	3
PRACTICALS						
6	CH 325	Process Dynamics and Control Lab	0	0	3	2
7	CH 326	Process Modeling Simulation And Optimization Lab	0	0	3	2
8	CH 355 CH 356	**Elective - I Lab** Surface Coatings Technology Lab Technology of Vegetable oils and Fats Lab	0	0	3	2
9		Industrial visit	0	0	0	0
TOTAL			**20**	**00**	**09**	**21**

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CH 321

BIO-CHEMICAL ENGINEERING

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:
1. To apply the principles of Chemical Engineering to bioprocesses.
2. Conduct an analysis on the biological factors that are important in the design, operation, performance, and/or monitoring of a biological process

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. Identify and explain the basic features of bioreactors
3. Describe the principles of the various separation procedures involved in the downstream processing of products

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 - R N Aand DNA, Amino acids to Proteins - the building blocks of biochemical life.Biosynthesis and Metabolic Pathways: Biosynthesis of Small and Macro Molecules Introduction ofmetabolic pathways and end products of glucose metabolism.

UNIT – II
Introductory Microbiology
Introduction to Microbiology: Classification and Industrial uses of MicroorganismsGrowth and Reproduction of Microbes: Growth cycle phases for batch cultivation. Monod's growthkinetics – 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 CSTR 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

UNIT – V
Bioprocess Technology
Fermentation Technology: Types of Fermentation - Anaerobic and Aerobic Fermentation process. Surface and Submerged Fermentation process Medium formulation and Culture Propagation: Media composition and Sterilization, Inoculum's culture development under aseptic conditions of transfer. Environmental biotechnology: Effluent treatment. Industrial Biotechnology: Commercial enzymes, Antibiotics and single cell protein

CH 321

Text Books:

1. James, E.Bailey and David F Ollis, “Biochemical Engineering fundamentals”, 2ndEdition, McGraw-Hill Internal Edition.1986

Suggested Reading:

1. Michael L. Shuler and FikretKargi, “*Bioprocess Engineering: Basic Concepts”.* Second Edition Prentice Hall, 2002

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CH 322

CHEMICAL ENGINEERING THERMODYNAMICS – II

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives: This course helps the students to understand

1. VLE for binary mixtures.
2. To generate T-x-y and P-x-y, from the fundamentals of equilibrium and properties of fluid.

Course Outcomes: The students will be able to

1. Generate VLE data for binary mixtures for ideal and non- ideal systems
2. to determine equilibrium constant and composition of product mixture at given temperature and pressure

UNIT - I

Criterion of Phase Equilibrium: Fundamental property relations, Chemical potential, Partial Properties, Relation between Partial Properties and Molar properties, Fugacity, Fugacity Coefficients, Determination of Fugacity Coefficient by equations of states (Virial, Van der Waal, R.K. equation.)

UNIT - II

Solution Thermodynamics: Fugacity of pure liquids, Fugacity for Mixtures, Poynting factor, Residual Properties, Excess Properties, Lewis Randall Rule, Activity Coefficients, Heat Effects of mixing.

UNIT - III

The Nature of Phase Equilibrium: The Phase Rule, Duhem's Theorem, Models to calculate Activity Coefficients (Margules Equation, Van-laar, Wilson), Introduction to UNIQUAC, UNIFAC. Method to get activity coefficients (Margules and Van laar) by using Excess Gibbs Free Energy models

UNIT - IV

Application of Phase Equilibrium: To get T-x-y, P-x-y, Using Raoult's law, Modified Raoult's law for binary mixtures, following methods of BUBBL-T, Dew-T, BUBBL-P, DEW-P. Algorithm to find VLE by Peng- Robinson, R-K- Equation

UNIT - V

Chemical Reaction Equilibrium: Reaction Coordinate, Equilibrium criteria for chemical reactions, equilibrium constant and 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. J M Smith and H C VanNess, "Introduction to Chemical Engineering Thermodynamics", McGraw Hill, International Edition, Fourth edition, 1987

Suggested Reading:

1. Pradeep Ahuja, "Chemical Engineering Thermodynamics" , PHI Publishers, EEE, 2009
2. YVC Rao, "Chemical Engineering Thermodynamics" Universities Press , 2003

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CH 323

ENERGY ENGINEERING

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:
1. Introduce the importance of energy sources
2. To explore the challenges facing and solutions found by energy engineers.
3. To introduce students to energy efficiency and renewable energy resources and how to develop a sustainable energy plan.

Course Outcomes: On successful completion of this module, students should be able to:
1. Understand scope of energy engineering
2· Quantify how much energy is available from renewable sources
3. Understand how deep energy efficiency improvements may be achieved

UNIT – I
Introduction: Introduction to conventional and non conventional energy sources, their significance & availability, consumption patterns in India.Energy survey and policies for India.

UNIT – II
Conventional Energy Sources:
Wood and Wood Charcoal, products of wood carbonization
Coal and Coal derived fuels, characteristics, production methods and uses.
Oil and Gases: Fuels derived from oil and gases, Characteristics, production methods and uses. Technology for combustion of fuels derived from oil and gas.
Shale oil and gas, oil sands.

UNIT – III
Non conventional Energy Sources:
Selective surfaces for solar Energy Conversion: Introduction. Heat balance. Physical Characteristics of Selective Surfaces
Use of Selective Solar Energy Collectors, Anti-Reflection Coatings,
Solar Reflector Materials, Selective and Non-Selective Surfaces. Types of Selective coatings, Intrinsic Solar Selective Materials
Photo Voltaic Cells: Introduction: Types of Solar Cells. Applications, Electrical Storage. Future developments
Wind-power: Introduction. Basic principles of wind energy conversion. Types of wind machines
Wave power: Introduction, advantages and disadvantages, energy and power from the waves. Wave energy conversion devices

UNIT – IV
Bio Fuels : Introduction. Bio mass conversion technologies. Wet processes, dry processes.Bio-gas generation. Factors affecting bio-digestion. Classification of biogas plants
Production methods, characteristics, uses of biodiesel, biobutanol, bioethanol
Second generation biofuel feed stocks
Fuel Cells: Working principle, Types, Advantages, Current and Future Applications.

UNIT - V
Nuclear Energy: Nuclear fission fuels processing, nuclear reactions and nuclear reactors
Energy Storage and Distribution: Mechanical Energy Storage, Hydroelectric Storage, Compressed Air Storage and Energy Storage via Flywheels. Electric Storage , Chemical Storage ,Thermal Energy Storage.

Text Books:
1. G D Rai, "Non -conventional energy sources," Khanna Publishers,4th edition, 2000
2. Samir Sarkar, "Fuels and Combustion", Universities Press,3rd Edition 2009

Suggested Reading:
1. Om Prakash Gupta, "Fundamentals of Nuclear Power Reactors", Khanna Publishers,
2. S Srinivasan, "Fuel Cells: From Fundamentals to Applications", Springer, 2006

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CH324

PROCESS MODELING SIMULATION AND OPTIMIZATION

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. This course is helpful to learn the formulation of a mathematical process model through the application of material and energy balance.
2. Students are introduced to mathematical solution procedures like numerical methods and optimization techniques to solve the formulated process models**.**
3. The course is helpful to provide know-how on process simulation software required in chemical engineering field.

Course Outcomes:

1. The students gain the ability to analyze, formulate and apply the basic fundamentals of mathematics like numerical methods & programming languages to solve problems related to chemical processes
2. The course helps the students to understand the steps involved in applying process simulation software packages for design, solution and optimization that are a prerequisite for the development of process flowsheets

Note: The Programs are to be written in "MATLAB"

UNIT – I Formulation of Process Models

Definition of mathematical models, introduction to process models, types, uses, scope of coverage, principles of formulation, conservation principles of mass and energy laws.

Application of fundamental laws to develop: Total and component continuity equations, energy equation, momentum equation, chemical kinetic rate expressions.

UNIT – II Numerical Solutions of Linear and Non-linear process models

Uses, comparison and computational significance for problem solving in chemical engineering for:

Set of linear simultaneous equations by Gauss-Elimination, Gauss-Jordan and Gauss-Seidel methods.

Set of non-linear equations by Bi-section, Reguli-falsi and Newton Raphson methods.

UNIT – III Curve-fitting and Numerical Solutions of Ordinary Differential Process Models

Computational features and problem solving in chemical engineering for:Curve-fitting by Linear and nonlinear least square analysis,

Set of ordinary differential equations by Euler's modified Euler's and RungeKutta methods.

UNIT – IV Chemical Process Optimization

Nature and organization, basic concepts and elements of Optimization, single variable functions, direct, indirect and random search methods – with and without acceleration

Elimination methods for unrestricted and exhaustive search, Fibonacci search, Dichotomous search, Golden-section (gradient) search methods

UNIT – V Simulation of Chemical Processes

Process modeling, MATLAB programming and use of Process Simulator like CHEMCAD on:Gravity flow tank, Batch reactor, Three CSTRs in series, Gas-pressurized CSTRs, Two-heated tanks, Heat-exchangers, Distillation columns, Packed-bed columns.

Text Books:

1. William L Luyben, "Process Modeling, Simulation and Control for Chemical Engineers", McGraw Hill Publishing Company,2nd edition, 1990
2. Edger T.E., and Himmelbau D.M., "Optimization of chemical processes", McGraw Hill international edition, 1988

Suggested Reading:

1. Steven C. Chapra and Raymond P Canale, "Numerical methods for Engineers", McGraw Hill International, 2nd edition, 1988
2. S.S. Rao, "Engineering Optimization"
3. Mickley H.S., Sheerwood T.K., Reed C.E., "Applied mathematics in Chemical Engineering", McGraw Hill, New York, 1957

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CH 351

SURFACE COATING TECHNOLOGY
(Elective - I)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:
To give fundamental concepts in pigments, extenders, binders, solvents, paint formulation, paint applications, manufacturing of different paints, special type paints, paint tests and paint defects.

Course Outcomes:
The students will be able to distinguish the differences between various types of paints and their composition.
The applicability of different paints for industrial purposes can be decided.

UNIT-I
Introduction: Surface coatings- Scope, properties, applications & uses. 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. Varnishes, Lacquers, resin their properties & uses.
Manufacture of Paints: Distempers- Manufacture, properties & uses. Powder Paints- Manufacture, properties & uses. Enamel - Manufacture, properties & uses.

UNIT – II
Pigments: Importance of pigments - their basic properties, uses & their applications.
Classification of pigments: Inorganic & organic pigments.
Special properties of pigments: Criteria for selection of color, tinting strength, fastness to light, bleeding, hiding power, refractive index, particle size & anti-corrosive properties.
Manufacture of Pigments: Titanium di-oxide, Zinc Oxide, Carbon black, red lead, Ultramarine blue, Prussian blue, Zinc chrome.

UNIT – III
Extenders: Importance, properties & significance.
Manufacture of Extenders: Blanc fixe, China clay, Gypsum, Mica & talc.
Solvents: Importance, uses & their properties,
Manufacture of solvents: Turpentine, di-pentene, pionoid, alcohols.
Natural Resins: Resin &shallock. Synthetic Resins: Alkyd resins, phenolic resins, amino resins.

UNIT – IV
Application methods of paints: Air drying paints, industrial liquid stoving paints & industrial stoving powder paints. Brush application, spray application, electrostatic spray application. Dip coating, Roller coating & electro deposition coating.
Testing of Paints: Wet paint & dry paint testing film thickness, adhesion & resistance coverage. Defects in paints & paintings & their remedies: defects in grinding skinning, sagging, bleeding, flooring, floating, brushing, orange peel, fish eye, brush marks, lifting.

UNIT – V
Special Coatings: Importance, Significance & their applications.
Powder Coatings, Water soluble coatings, Water Borne coatings, heat resistant coatings, automatic coatings, fire retardant coatings, space & air craft coatings & swimming pool coatings.

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

Suggested Reading:

1. Patton Temple, “C Pigment Flow & Pigment Dispersion”, Wiley Inter science, 1979
2. Swaraj Paul, “ Surface Coatings science and technology” , 1995

CH 352

TECHNOLOGY OF VEGETABLE OILS AND FATS
(ELECTIVE – I)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:
1. To impart knowledge about sources, types and composition of oils and fats
2. To comprehend the physicochemical characteristics
3. To familiarize the students about extraction and processing
4. To study the production of value added products from oils and fats

Course Outcomes: At the end of the course the student will be able to:
1. Analyze the various properties of fats and oils to determine their use in food, soap and other industries
2. Identify unit operations involved in extraction and refining processes
3. Will know about the degradation occurring during storage of oils and fats and prevention methods

UNIT – I
Introduction: Position of Oils & Oilseeds in India & world, definition, structure, composition of oils and fats, distinction between oils and fats
Glycerides: Definition and types – Simple, mixed triglycerides, mono and diglycerides, Distribution of fatty acids in glyceride molecule
Fatty Acids: Saturated fatty acids, unsaturated fatty acids (Fatty acids with one, two, three and more double bonds) Fatty acids of unusual structure: Hydroxyl and di-hydroxy acids - Acetylene acids – Epoxy acids and keto acids
Non-glyceride Components: Phosphatides, sterols, pigments, tocopherols, tocotrienols, oryzanol, β-carotene, squalene

UNIT – II Classification of Oils and Fats
Classification of Oils and Fats with Examples, Physical and chemical properties (structure indices – iodine value, saponification value, hydroxyl value) of oil and fats, detailed glyceride composition
Industrial Utilization of the following oils – palm, palm kernel, coconut, cotton seed, peanut, sunflower, safflower, sesame, rice bran, rapeseed and mustard, linseed (flax seed), soya been, Tung, castor oil, lard, tallow and fish
Nontraditional oils like neem, karanja and jatropafor industrial applications

UNIT– III Chemical Reactions of Oils and Fats
Reactions in the fatty acid chain - Hydrogenation, Oxidation reactions.Esterification andInteresterificationSopanification, formation of metal soaps ,Hydrogenolysis, formation of fatty amines, fatty amides and fatty chlorides, Halogenation, Addition of maleic anhydride, sulfation, sulfonation Chemical oxidation(hydroxylation), atmospheric oxidation (rancidity), Polymerization, Isomerisation and Reaction of hydroxyl groups

UNIT – IV Storage, Pretreatment and Extraction of Oil Seeds: Mechanical expression of oil – extruder expander, Solvent extraction, Fat Splitting (chemical and enzymatic methods)

UNIT – V Chemical and Physical Refining: De-gumming, neutralization, refining losses, Miscella refining, Bleaching, dewaxing, Deacidification and Deodorization
Partial and Total Hydrogenation: Mechanism, selectivity, continuous process, preparation of Raney Nickel catalyst. Products of hydrogenation - anaspati, Margarine and Shortening
Soap Manufacture: Raw materials required , selection of raw materials – Full boil process
Concepts about surfactants, detergents, cosmetics, lubricants, biodiesel, Regulations of FSSAI related to oils and fats

Text Books:
1. Ed. D Swern, "Bailey's Industrial Oils and Fats Products" , Wiley Inter Science publication, N.Y. John Wiley and Sons ,6th Edition, 2006

Suggested Reading:
1. M M Chakrabarty , "Chemistry and Technology of Oils and Fats", Allied Publishers Pvt.Ltd., 1st Edition, 2007
2. O P Narula, "Treatise on fats,Fatty acids and Oleochemicals", Vol I and II, Industrial Consultants (India), 1994
3. R J Hamilton , "Recent Advances in Chemistry and Technology of Fats and Oils", Elsevier Applied Science 1987

CH 325

PROCESS DYNAMICS AND CONTROL LABORATORY

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

List of Experiments:

1. Determination of order, time constant, and dynamic lag of a first order system
2. Determination of frequency response of a first order system
3. Determination of Bode plot from dynamic studies of first order system
4. Study the effect of PID controller parameters on closed loop servo response
5. Feedback controller tuning by Zeigler-Nicolas and Cohen Coon Methods
6. Determination of order, time constants, interaction effective time constant of interacting liquid level system
7. Determination of order, time constants of two tank non-interacting liquid level system
8. Determination of order, time constants, interaction, effective time constants and dynamic lag of a second order system
9. Determination of second order under damped characteristics from the dynamics of second order system (manometer)
10. Determination of pneumatic valve characteristics
11. Study of Cascade control system
12. Evaluation of model based nonlinear control on continuous bioreactor with input multiplicities
    a. Calculation of overall heat transfer coefficient and effectiveness of the given heat exchanger
    b. Study of dynamics of heat exchanger

Note: 1. Experiments (1 to 5) can be designed on any of the following computer controlled systems.
  a. Liquid-Level
  b. Flow
  c. Temperature
  d. Pressure
  e. Jacketed stirred tank

2. Minimum of 8 experiments have to be performed

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CH 326

PROCESS MODELING SIMULATION AND OPTIMIZATION LABORATORY

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. The laboratory sessions equip the students in computer aided problem solving. The sessions are further helpful in interpreting the results and to write technical reports in the form of lab records.
2. The course aims to provide the students with opportunity to run simple process simulators for the study of design and analysis of processes or equipment in chemical plant operation.
3. The lab sessions aim to provide an opportunity for team work in solving chemical engineering related simple problems.

Course Outcomes:

1. The students are able to express the experimental data in the form of suitable mathematical correlations and estimate the coefficients involved.
2. In the lab, the students are exposed to process simulation of common chemical engineering unit operations.
3. The students are able to work as a team and develop process models as well as apply their mathematical skills to solve them.

Note: The Programs are to be written in "MATLAB"

PART – A: INTRODUCTION

Basics of theoretical modeling, and Numerical solutions for Process Calculations:

1. Solution of ordinary differential equations by Euler`s, Modified Euler`s, Runge-Kutta methods
2. Solution of set of linear simultaneous equations by Gauss-elimination, Gauss-Jordan and Gauss-Seidel methods
3. Solution of non-linear equations by bisection, Regular-Falsi and Newton Raphson methods
4. Linear and Non-linear Least square analysis

PART – B: APPLICATION

(A minimum of 4 process systems to be simulated)

1. Series of isothermal, constant holdup CSTRs
2. Two heated Tanks
3. Gas-Phase Pressurized CSTR
4. Batch Reactor - Adiabatic or Isothermal
5. Ideal Binary distillation
6. Vapor Liquid Equilibrium : Bubble Point and Dew Point Calculations

PART – C: PROCESS SIMULATORS

Application of process simulation software packages like ChemCAD for:
understanding the basic concepts, steps involved for developing process flowsheet

Suggested Reading:

1. William L Luyben, “Process Modelling, Simulation and Control for Chemical Engineers”, McGraw Hill, 2nd edition 1990
2. B Wayne Bequette, “Process Modelling Analysis and Simulation”, Prentice Hall International Series, 1998
3. Steven C Chapra and Raymond P Canale, “Numerical methods for Engineers”, McGraw Hill, 2nd edition, 1988

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CH 355

SURFACE COATING TECHNOLOGY LAB
(ELECTIVE - I LAB)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives

To understand the theoretical concepts of organic surface coating technology (Paints) the experimental procedure were designed like preparation of M.S. panels for painting, viscosity tests, adhesion tests, impact tests, gloss tests, thickness tests, paint spreading capacity tests and corrosion tests.

Course Outcomes:

With the conceptual experimental procedures, analysis with theoretical and experimental values and with good evaluation procedures, the students are made to be perfect in analytical skills and then these skills are useful to them in industries.

LIST OF EXPERIMENTS
(Minimum of 8 experiments are to be performed)

1. Preparation of panels for painting
2. Determination of apparent viscosity of paints, varnished lacquers and viscous products
3. Using B-4 ford cup (type I S . 101/IS 3944/BS 3900) - Determination of resistance to scratching under a specified load of a dried film of paint (as Per IS . 101)
4. Measurement of paint film thickness using dry film thickness gauge of a first coat (primer Paint) and second coat (finish paint)
5. Determination of flexibility and adhesion of the paints (as per 101 BS 3960 m and size ¼)
6. Determination of impact resistance of the painted panel
7. Measurement of hardness of magnesium phosphate coating
8. Measurement of gloss of painted film at 45 degree angle
9. Determination of drying consistency of different paints and varnishes
10. Determination of coverage or spreading capacity of different paints

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CH 356

TECHNOLOGY OF VEGETABLE OILS AND FATS LABORATORY(ELECTIVE – I LAB)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

List of Experiments:

1. Determination of Acid value of given oil sample
2. Determination of percentage of free fatty acid present in given sample and its acid value
3. Determination of iodine value of given oil sample
4. Determination of saponification value of given oil sample
5. Determination of the hydroxyl value of given oil sample
6. Determination of unsaponifiable matter of given oil sample
7. Determination of oil content in oil seeds
8. Determination of slip melting point of Fats (Ex: vanaspati, tallow)
9. Determination of the percentage of moisture and any materials volatile under the conditions of test
10. Determination of Total Fatty Matter (TFM) in soaps

Note: Minimum of 8 experiments have to be performed

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CH421 **PLANT DESIGN AND ECONOMICS**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course objectives: This course helps the students to understand the:
1. fundamentals of investments and engineering economics.
2. flowsheet 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.

Course outcomes: After completion of the course student should 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. calculate the Rate of return and payout time for design of any process plant.
4. evaluate the profitability of process industry projects using measures such as ROI, NPV and DCF
5. identity and apply the selection criteria for design of flowsheets, equipment and material.
6. 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.

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 Reading:
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.

CH 422

TRANSPORT PHENOMENA

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives: Introduces the students to
1. Fundamentals to solve flow problems involving transport of momentum, energy and mass using a unified approach.
2. The analogy between momentum, mass and energy transport.
3. The turbulent phenomena and the methods of characterizing the turbulent fluxes
4. Equations of change for isothermal and non-isothermal systems and multi-component mixtures.

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
6. Time smooth equations of change.

UNIT – I

Introduction – Mechanism of molecular transport of momentum, heat and Mass Transfer. Flux equations – Newton"s, Fouriers" 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. Creeping flow around sphere

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 in curvilinear coordinates, 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, 1960
2. R.B.Bird, W.E.Stewart, and E.N.Lightfoot , "Transport Phenomena", John Wiley & Sons. Inc. 2002

Suggested Reading:
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

CH 471

CORROSION ENGINEERING
(ELECTIVE − III)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives: This course helps the students to understand the:
1. definition and classification of corrosion.
2. principles of corrosion, common corrosion forms,
3. different corrosion testing methods.
4. corrosion control methods and material selection for cost reduction.
5. modern theories to explain corrosion

Course Outcomes: At the end of the course, student will be able:
1. identity the type of corrosion.
2. correlate the damage with the cause of corrosion.
3. identify the correct method of testing any corrosion.
4. select the appropriate preventive method to avoid corrosion.
5. select the significant coating for corrosion prevention.
6. apply modern method of corrosion measurement.

UNIT− I: Introduction:
Definition, corrosion environments, damage, classification of corrosion. Principles and corrosion rate expressions. Environmental effects such as velocity, temperature, galvanic coupling. Metallurgical and other aspects

UNIT− II: Different forms of corrosion:
Uniform attack, galvanic corrosion, crevice corrosion, fitting corrosion, inter– granular corrosion, selective leaching, erosion corrosion, stress corrosion and hydrogen damage.
Pitting: pit shape and growth, velocity, metallurgical variables, evaluation of pitting damage, prevention.

UNIT− III: Corrosion testing methods:
Classification, purpose, surface preparation, measuring and weighing, duration, plant interval test, NACE test methods, slow – strain rate test and paint test.
Composites testing: Exposure techniques, Huey test, Sea water test, Stress corrosion, Corrosion of palstics, Invivo corrosion.

UNIT −IV: Corrosion prevention methods:
Selection of metals and alloys–Cast iron, steel, Al, Mg, Ti, Composites and Refractory metals.
Non-metallics: Thermosetters, laminates and reinforced plastics, Rubbers, Wood, Ceramics, Carbon and Graphite. Alteration of environment such as changing mediums, lowering temperature, design rules, design of cathodic and anodic protection, selected coating techniques to prevent corrosion; Failure analysis. High temperature corrosion.

UNIT −V: Advanced techniques:
Modern theory–principles and applications, electrode kinetics, predicting corrosion behavior, corrosion prevention, Corrosion rate measurements in Petroleum Industry with examples.

Text Books:
1. Pierre R. Roberge, " Handbook of Corrosion Engineering", 2nd edition, MCGraw-Hill, Newyork, 2012
2. Zaki Ahmad, "Principles of Corrosion Engineering and Corrosion Control", Butterworth-Heinemann, 2006.

Suggested Reading
1. Pierre R Roberge, "Corrosion Engineering – Principles and Practice, MCGraw-Hill, 2008
2. Pierre R. Roberge, Corrosion Basics: An Introduction, NACE International, 2006.

Web resources :
1. www.academia.edu/5491377/corrosion_engineering_mars_g._fontana

CH 472 **FLUIDIZATION ENGINEERING**
(ELECTIVE – III)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credit	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. Calculate the minimum fluidization velocity and optimum operating fluidization velocity.
2. Design the cooling tube length for required heat transfer area.
3. Design the complete fluidized bed in terms of pressure drop across the bed a
4. Design the distributors, TDH, height, diameter, power consumption of compressor for air.
5. Distinguish between boiler and furnaces, methods of starting up.
6. Calculate the amount of chemicals required to control the emission like SO2.

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 sharp, 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, Design for physical operation, Batch and continuous operation for Mass & Heat Transfer and Drying of solids.

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, pressurized fluidized bed combustion, 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 SO2.

Text Books:
1. J.R. Howard Adam Hilger, "Fluidized Bed Technology -Principles & Applications", IOP, Pub Ltd., NY. 1989.

Suggested Reading
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.

CH 473 **POLLUTION CONTROL IN PROCESS INDUSTRIES**
(ELECTIVE – III)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course objectives: This course helps the students to understand:
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. the essential principles and equipment used in industrial pollution abatement

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. analyze the effect of climate changes, atmospheric dispersion of air pollutants, and operating principles.
3. design and calculate the required particulate control devices.
4. quantify and analyze industrial wastewater and its treatment.
5. identify appropriate unit operations & unit processes for conversion of polluted water to bearable standard limits.
6. 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 Solid waste management:
Industrial solid wastes – Types, classification, properties, management and general disposal methods. Hazardous industrial solid wastes – environmental effects and disposal methods commonly practiced.
Methods practiced in chemical, 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 Reading
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.

CH 474

SUGAR TECHNOLOGY
(ELECTIVE – III)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 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 byproducts of any sugar industry and production of salable derivatives.

Course Outcomes: At the end of the course, student will be able to apply the
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.
6. methods to reclaim byproducts.

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 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 Reading:

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.

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CE 422

DISASTER MITIGATION AND MANAGEMENT
(ELECTIVE – IV)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:
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, mechanism causes, consequences and mitigation measures of the various natural disasters including hydro metrological and geological based disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters including chemical, biological and nuclear warfare agents.
4. To equip the students with the knowledge of various chronological phases in the disaster management cycle.
5. To create awareness about the disaster management framework and legislations in the context of national and global conventions.
6. To enable students to understand the applications of geospatial technologies like remote sensing and geographical information systems in disaster management.

Course Outcomes:
1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at local level
2. Ability to 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 natural and human induced disasters for the participatory role of engineers in disaster management.
4. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans
5. Ability to understand various participatory approaches/strategies and their application in disaster management
6. Ability to understand the concepts of remote sensing and geographical information systems for their effective application in disaster management.

UNIT-I:
Introduction to Natural, human induced and human made disasters – Meaning, nature, types and effects; International decade of natural disaster reduction (IDNDR); International strategy of natural disaster reduction (ISDR)

UNIT-II:
Natural Disasters– Hydro meteorological disasters: Causes, impacts, Early warning systems, structural and non-structural measures for floods, drought and cyclones; Tropical cyclones: Overview, cyclogenesis, drought monitoring and management.; Geographical based disasters: Earthquakes and Tsunami- Overview, causes, impacts, zoning, structural and non-structural mitigation measures; Tsunami generation; Landslides and avalanches: Overview, causes, impacts, zoning and mitigation measures. Case studies related to various hydro meteorological and geographical based disasters.

UNIT III:
Human induced hazards: Risks and control measures in a chemical industry**,** Causes, impacts and mitigation measures for chemical accidents, chemical disaster management, current status and perspectives; 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 and traffic accidents .

UNIT IV:
Use of remote sensing and GIS in disaster mitigation and management; Scope of application of ICST (Information, communication and space technologies in disaster management, Critical applications& Infrastructure; Potential application of Remote sensing and GIS in disaster management and in various disastrous conditions like earthquakes, drought, Floods, landslides etc.

UNIT V:
Concept of Disaster Management: Introduction to disaster management, Relationship between Risk, vulnerability and a disaster, Disaster management cycle, Principles of disaster mitigation: Hazard identification and vulnerability analysis, Early warning systems and forecasting; Infrastructure and development in disaster management; Disaster management in India: National disaster management framework at central, state, district and local levels. Community based disaster management.

Text Books:

1. Rajib, S and Krishna Murthy, R.R, "Disaster Management Global Challenges and Local Solutions" Univ. Press Hyd., 2012.
2. Notes / Reading material published by National Disaster Management Institute, Ministry of Home Affairs, Govt. of India.

Suggested Reading:

1. Navele, P & Raja, "C.K. Earth and Atmospheric Disasters Management, Natural and Manmade". B.S. Pub., Hyd., 2009.
2. Fearn-Banks, K, "Crises computations approach: A case book approach", Route ledge Pub., Indian Edu., New York 2011.
3. Battacharya, T., "Disaster Science and Management", Tata McGraw Hill Company, New Delhi, 2012.

ME 464

ENTREPRENEURSHIP
(ELECTIVE – IV)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To understand the essence of Entrepreneurship
2. To know the environment of industry and related opportunities and challenges
3. To know the concept a procedure of idea generation
4. To understand the elements of business plan and its procedure
5. To understand project management and its techniques
6. To know behavioral issues and Time management

Outcomes: After completing this course, students will be able to:

1. Apply the entrepreneurial process
2. Analyze the feasibility of a new business plan and preparation of Business plan
3. Evaluate entrepreneurial tendency and attitude
4. Brainstorm ideas for new and innovative products or services
5. Use project management techniques like PERT and CPM
6. 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”, Tata Me Graw Hill Publishing Company Ltd., 5lh Ed., 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.

PE 484

NANO MATERIALS AND TECHNOLOGY
(ELECTIVE – IV)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. Students are able to understand the nanotechnology approach and challenges
2. To give the student familiarities about materials of nanotechnology
3. Students are able to understand the nano structurers
4. Students are able to learn nano fabrication
5. Students are able to understand special nano materials
6. Students are able to understand bio materials

Outcomes: At the end of the course

1. Understand the developments and challenges in nano technology
2. Understand synthesis and properties of nanostructured materials
3. Analyze magnetic and electronic properties of nano materials
4. Analyze nano fabrication methods and their applications
5. Understand the characterization of nano and bio materials and their use
6. Analyze the synthesis and characterization of nano wires and tubes

Unit I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance of Nanotechnology, Bottom-up and Top-down approaches, challenges in nanotechnology, proximal probe technologies.

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, FFM

Unit III

Nano Structures: Zero dimensional Nanostructure (Nano particles), synthesis procedure, characterization techniques, properties and applications of Nano particles

One dimensional Nanostructures (Nano Wires, Nano Tubes), various Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires, Types of Nano Tubes, Synthesis procedure, characterization properties and applications of Nano Tubes

Unit IV

Nano Fabrication: Introduction, Basic fabrication techniques (Lithography, thin film deposition, and doping), MEMS fabrication techniques, Nano fabrication techniques (E-beam Nano-imprint fabrication, Epitaxy and strain engineering, Scanned probe techniques).

Unit V

Special Nano Materials: Nano Composites: Introduction, Synthesis procedures, various systems (metal-polymer, metal-ceramics and Polymer-ceramics), Characterization procedures, applications, Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, principles involved, applications

Text Books:

1. A.K. Banopadyay, „Nano Materials", New Age Publications
2. T. Pradeep, „Textbook of Nanoscience and Nanotechnology", McGraw Hill Edu. (India) Pvt Ltd., New Delhi
3. Dieter Vollath, Nanomaterials: An Introduction to Synthesis, Properties and Applications,Wiley, 2013

Suggested Reading:

1. Carl C. Koch, „Nano Materials Synthesis, Properties and Applications", Jaico Publishing House
2. Willia Tllsey Atkinson, „Nano Technology", Jaico Publishing House
3. George W. Hanson, „Fundamentals of Nanoelectronics", Pearson Education, 2009
4. T. Pradeep, „Nano: Essentials-understanding Nano Science and Technonology", TMH, 2007
5. Sabu Thomas, Nandakumar Kalarikkal, A. Manuel Stephan, B. Raneesh, "Advanced Nanomaterials: Synthesis, Properties, and Applications", Apple Academic Press

CH 481

NUCLEAR ENGINEERING
(ELECTIVE – IV)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives: This course helps the students to understand:
1. fundamentals of nuclear fission reactions and products.
2. types of nuclear fuel materials, properties, characteristics.
3. nuclear fuel separation and enrichment methods along with flowsheets.
4. non-fuel materials required for design of the reactor structure, cladding and for moderation.
5. different types of reactors, concepts of heat removal, control and safety systems.
6. spent fuel management.

Course Outcomes: At the end of the course, student will be able to apply the:
1. identify the various radioactive elements based on the mechanism of fission process.
2. processing and handling techniques for enrichment of fuel materials.
3. properties and radiation effects of materials for design of cladding structure.
4. concepts of fuel source, heat removal, control and safety needs for operation of nuclear reactors .
5. design and working of fast breeder reactors.
6. techniques practiced for handling, storage and reprocessing of spent fuel.

UNIT – I: Nuclear fission
Atomic structure and isotopes of radioactive material, nuclear elements, nuclear binding energy, radioactive nuclides and nuclear stability, radioactivity, radioactive decay - alpha decay, beta decay, gamma rays.
Neutron reactions, fission cross-sections, fission rate and reactor power, prompt and delayed fission neutrons, fission products.

UNIT – II: Nuclear fuel materials
Types of fuel materials, properties and significant characteristics, fuel cycle, pre-reactor fuel operations, isotopic enrichment, isotopic separation requirements. Nuclear fuel utilization – breeding ratio, Uranium, Thorium and Plutonium utilization.

UNIT – III: Non-fuel reactor materials
Classification, mechanical properties, radiation effects of materials, corrosion of metals, structural and cladding materials, moderator and reflector materials.

UNIT – IV: Nuclear fission reactors
General features, classification, reactor development for power production. Design features, concepts of heat removal, control and safety systems for: pressurized water reactors (PWR), boiling water reactors (BWR). Heavy water moderated reactors (HWMR) and Fast breeder reactors (FBR).

UNIT – V: Spent fuel management
Characteristics of spent fuel, storage, disposal, reprocessing of spent fuel, solvent extraction separation process, other possible separation processes.

Text Books:
1. Samuel Glasstone and Alexander Sesonske, "Nuclear Reactor Engineering", 3rd Ed, CBS Publishers and distributors, New Delhi, 1986.

Suggested reading:
1. Benjamin M. MA, "Nuclear reactor materials and applications", Van Nostrand Reinhold Co., New York, 1975.
2. John R. Lamarsh, "Introduction to Nuclear Engineering", Addison-Wesley publishing Co., Philippines, 1975.
3. Raymond L. Murray, "Nuclear Energy", Pergamon Press, New York, 1975.

I/c HEAD
Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

CH 423

SEMINAR

Instruction	3L Periods per week
Sessionals	25 Marks
Credits	**1**

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of 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. Students are to be exposed to following aspects of seminar presentations.

- Literature survey
- Consolidation of available information
- Power point Preparation
- Technical writing

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Give twenty(20) minutes presentation through OHP/ PPT/ Slide Projector followed by Ten(10) minutes discussion
3. Submit a report on the seminar topic with list of references and hard copy of the slides.

Seminars are to be scheduled from 3^{rd} week to the last week of the semester and any change in schedule should 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 should be from any peer reviewed recent journal publications.

CH 901

PROJECT

Instruction	6L Periods per week
University Examination	Viva-voce
University Examination	100 Marks
Sessionals	50 Marks
Credits	9

Dealing with a real time problem should be the focus of under graduate project.

All projects will be monitored at least four times in the II-semester through individual presentations (Project batch wise).

Every student should maintain a project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Sessional marks should be based on the marks, awarded by a project monitoring committee of faculty members as well as the marks given by the guide.

Common norms are established for final documentation of the project report, the students are directed to download from the website regarding the guidelines for preparing the project report and the project report format.

The project report shall be evaluated for 100 Marks by the External Examiner.

If the project work found inadequate in the end examination, the candidate should repeat the project work with a new problem or improve the quality of work and report it again.

Break up for 100 Marks in the end examination:

1.	Power point presentation	20 Marks
2.	Thesis/Report preparation	40 Marks
3.	Viva-voce	40 Marks

I/c HEAD
Dept. of Chemical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-75.

16CE C03

SURVEYING

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 enable the student understand the basic principles of surveying and its role in civil engineering.
2. To make the student understanding about the levelling operations and methods of computations for finding areas and volumes.
3. To enable the student to get acquainted with simple angular measurements and understanding the operations of modern instruments like Total station and GPS instruments .
4. To make the student to know about the computation data required for setting curves like simple ,compound and reverse curves.
5. To enable the student to understand the role of transition curve and the data necessary for setting vertical curves.

Course out comes:

1. To use the instruments like chain, compass and plane table and gets an idea about the circumstances in which they can be used in field.
2. To know the methods of levelling along with developing of contours and use the contours in civil engineering related problems.
3. To get exposure to the modern instruments like Total station and GPS instruments.
4. To be in a position to set various horizontal curves .
5. To be able to compute the data required for setting vertical curve and able to understand the difference between transition curve and other horizontal curves.

UNIT1:

Principles of surveying, objectives of surveying and classifications of surveying, Basic principles of Chain surveying, types of chains and accessories required for chain surveying various lines used in chain survey, computation of areas using offsets, principles of compass survey, concepts of meridians, bearings and systems of measuring bearings and computations of angles from bearings. Principles of Plane table surveying accessories required for plane table survey, Radiation, intersection and concepts of resection.

UNIT-II:

Levelling : Concepts of levelling, terms used in levelling, reduction of levels, types of levelling, corrections in levelling, errors in levelling, Contours- definition, contour interval, characteristics, methods of contouring and interpolation and uses of contours, estimation of volumes using Trapezoidal and Simpson's method.

UNIT-III:

Theodoiite- introduction, terms used , fundamental lines, uses ,traversing - types, checks, plotting, consecutive coordinates- Total coordinates, balancing of traverse, Gale's traverse table, Errors in theodolite survey, omitted measurements, Total station - working principle and its applications in surveying. Fundamental principles of tachometry, concepts of fixed hair method of tachometric survey. GPS survey - working principles, methods of GPS survey.

UNIT-IV:

Curves- types, designation of curves, terms used in curves, elements of curves, Angular methods of setting of simple curves, elements of reverse and compound curves.

UNIT-V:

Transition curves- principles, fundamental equation of transition curve , length of transition curves-arbitrary gradient, time rate, rate of change of radial acceleration, ideal transition curve- modified, cubic parabola and spiral curves. Vertical curves- types, chord gradient method and tangential correction methods of finding elevations.

Text Books:

1. C. Venkata Ramaiah, "A Text book of Surveying", University press, Hyderabad, 1997.
2. B.C. Punmia "Surveying vol. I and II", Laxmi Publications, 1994.

Suggested Reading:

1. T.P. Kanetker and S.V.Kulkarni Surveying and Levelling, PuneVidyarthi Gruha Prakashan, Pune,1994.
2. AM. Chadra, "Plane Surveying", New Age International", 2007.
3. Dr. K.R. Arora, "Surveying", Standard Book House, 2011.
4. R. Subramanyam, " Surveying and leveling", 2nd edition oxford university press, New Delhi.

16CE C04

BUILDING MATERIALS PLANNING & CONSTRUCTION

Instruction	3T+1D 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 student

1. To study about the basic building materials, properties and their applications.
2. To know the smart building materials, types of paints and varnishes.
3. To understand different types of masonries and their applications
4. To acquire concepts in building planning, arrangement of windows, doors, electrical and plumbing services.
5. To acquire ability to draw, plan, section, elevation of buildings with a flat /sloped roof.

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 doors, windows , roofs, stair used in building works.
4. To plan suitable types of building for given requirement including arrangement of electrical and plumbing services.
5. To prepare plan, section and elevation of building with flat / sloped roof of client requirement.

UNIT-I:

Traditional Building Materials: Properties, Types, Applications and testing of traditional building materials, Mud, Stone, Timber & Brick, Cement Fly Ash Sand, Aggregate Mortar, Concrete and Steel.

UNIT-II:

Emerging Building Materials: Smart and Eco Friendly materials - Sustainable materials - Recycled materials.

Miscellaneous Materials: Paints, Varnishes and Distembers - Water proofing materials and other construction chemicals.

UNIT - III:

Building Elements: Walls - Brick and Stone Masonry Walls **Brick Bonds:** Plan and isometric view of wall junctions for half brick wall ; one and one and a half brick wall. Brick masonry courses for odd and even courses of English and Flemish bond.

Stone Masonry: Elevation, sectional plans and cross sections of walls of Ashlar , CRS I and II sorts, URCS and RR stone masonry.

Doors and Windows: Various types and advantages - Introductory concepts and types of Roofs, beams, columns, Foundations and stairs. Different types of steel sections and roof trusses.

UNIT-IV:

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 - planning a single storied residential building with one, two and three bedrooms - preparation of drawings.

UNIT-V:

Drawing of plans, sections and elevations and sections of a single storey 1,2 and 3- bed room residential buildings and an industrial shed with steel roof trusses mounted on steel stanchions.

Text Books:

1. Sushil kumar, "Building Construction", Standard Publishers,1992.
2. S.P.Arora & S.P.Bindra, "A text book of Building Construction", Dhanpat Rai Publications.

Suggested Reading:

1. P.C. Vergiees -Building materials and construction.
2. CBRI Rookee, "Advance in Building Materials and construction".
3. NIIT, Chandigarh - Civil Engineers Material.
4. National Building Code of India, 2006.

16CE C05

STRENGTH OF MATERIALS - 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: To enable the student

1. Understand the basic concept of the stress and strain and stress - strain behaviour of different materials.
2. Draw shear force and bending moment diagrams for statically determinate beams.
3. Understand bending stress and shear stress.
4. Comprehend compound stresses, direct and bending stresses in beams.
5. Analyze thin and thick cylinders for fluid pressure and /or shrink fit pressures and to analyze perfect frames by different methods.

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 compute Shear force and Bending moment of statically determinate beams.
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 and to evaluate forces in the members of truss / frames.

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 stresses, distribution across rectangular, circular, triangular, I, T, H and diamond sections .

UNIT-IV:
Direct and bending stresses : Basic concept, Eccentric loading, limit of eccentricity - core of sections-rectangular and circular, solid and hollow sections.
Compound Stresses and Strains: Stresses on oblique planes, principal plane and principal stresses. Ellipse of stress and Moh's circle of stress.

UNIT-V:
Thin cylinders: Thin cylinders subjected to internal fluid pressure. Volumetric change Wire winding of thin cylinders.
Thick cylinders & spheres: Lame's equations, stresses under internal and external fluid pressure. Compound cylinders-shrink fit pressure.

Analysis of perfect frames / truss: Analysis of trusses by method of joints and method of sections.

Text Books:
1. B.C.Punmia, Mechanics 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.
2. D.S. Prakash Rao, Strength of Materials-A Practical Approach, Universities Press, Hyd 1999.
3. E.P. Popov, Engineering Mechanics of solids, 1993.
4. G.H. Ryder, Strength of Materials, 3rd Edition in SI units, Macmillan India Ltd,
5. A.Pytel and F.L.Singer, Strength of Materials , Harper & Row , 4th Edition, New York,1987.

16CE C06

ENGINEERING GEOLOGY

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. Enable the student know about various types of rocks, their orgin, formation and geological structures.
2. Enable the student understand the occurrence and movement of ground water and know the provinces of ground water in India.
3. Enable the student understand the engineering properties of rocks and their stress-strain behaviour.
4. Enable the student get the concepts of geological investigations on a site.
5. Enable the student understand the geology of dams, tunnels and also get the awareness of geological hazards.

Course Outcomes:

1. To identify various types of rocks, their properties, utility and suitability for construction purposes.
2. To identify various rock deposits in India and thus suggest suitable types of foundation.
3. To implement the geological investigations on site.
4. To suggest suitable measures for the construction of Dam and Tunnels.
5. To suggest suitable preventive / remedial measures as part of mitigation and management of geological Hazards.

UNIT-I

Rocks: Distinguishing feature of Igneous, Sedimentary and Metamorphic Rocks, Geological description of Granite, Basalt, Dolerite, Gabbro, Laterite, Sandstone, Shale, Limestone, Slate, Gneiss, Quartzite and Marble, Khondalite and charnocite.

Geological Structures: Folds , Fractures (joints)and faults - Fundamental types, mechanism, originand classifications, field identification and Engineering analysis of folds, Fracture (joints) and faults as mechanical defects of rock masses.

UNIT-II

Rock weathering: Processes and end products of weathering, Susceptibility of rocks to weathering, assessment of the degree of weathering, Tests of weather ability, and engineering and Engineering classifications of rock weathering.

Geology of Soils: Formation of soils, nature of parent materials, relative stability of minerals, important clay minerals, geological classification ,description and engineering types of soils and Uses.

Hydrogeology: Hydrological Cycle, water table, aquifers, occurrence of ground water in various lithological formations, Ground water movement, springs, ground water exploration, Ground water provinces of India.

UNIT-III

Rock Mechanics: Engineering properties of rocks, Stress - strain behaviour of rocks.

Site Investigation and Geo techniques: Geological maps and aerial photographs. Electrical Resistivity and seismic refraction methods, Bore hole drilling., suspension, Ground anchors.

UNIT-IV

Rocks as a construction material: Geological considerations in the selection of concrete roofi aggregate, Highway and Runway aggregates, Building stones, Decorative Facing stones. Geology of Dams and **Reservoirs:** Types of dams, Dam foundation and reservoirs, Engineering geological investigations for a masonry dam site; analysis of dam failures in the past .Engineering Geology of major dam sites of India.

UNIT-V

Tunnels: Stand-up time of different rocks, Engineering geological investigations of tunnels in rock, problems in tunneling, pay line and over break, logging of tunnels and Geology of some well known tunnels.

Geological Hazards: Geographical aspects of earthquake, tsunamis and landslides. Disaster prevention Mitigation and management.

Text Books:

1. Parbin singh, "A Text Book of Engineering and General Geology", Eighth revised edition, S.K. Kataria & Sonce, 2010.
2. Chenna Kesavulu.N, "A Text Book of Engineering Geology", Macmillan, 2004.
3. Dugal S.K etal.,"Engineering Geology",McGraw Hill Education(India) (P)Ltd., 2014.

Suggested Reading:

1. Fundamentals of Engg. Geology, F.G.Bell, Butterworths Publications, 1980, Aditay Books Pvt Ltd., New Delhi, 1992.
2. Krynine& Judd, Principles of engineering Geology & Geotechnical, CBS Publishers and Distributors, First Edition, 1998. Additional Reading.
3. P.B.Attewell and I.W. Farmer, Principles of Engineering Geology, Chapman and Hall 1976.
4. Officers of the Geological Survey of India, 'Engineering Geology Case Histories MiscilleaneousPublication No. 29, 1975.
5. K.S.Valdiya, 'Environmental Geology', Tata McGraw Hill, 1987.
6. R.V.G.K. Gokhale, Engineering Geology, BS publishers, 2005.

16MT C05

ENGINEERING MATHEMATICS-III

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

Course objectives:

1. To study the expansion of functions in various intervals.
2. To form P.D.E and to find its solution.
3. To solve Wave, Heat & Laplace equations.
4. To learn Differentiation and Integration of complex valued functions.
5. To evaluate Complex Integration.
6. To evaluate Real definite integrals.

Course outcomes: On the successful completion of this course the student will be able to

1. Expand functions in the given intervals.
2. Solve linear and non linear PDEs.
3. Solve one-dimension, two-dimension, Heat steady state equations and also one-dimension wave equation.
4. Solve problems on Analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Expand functions by using Taylor's and Laurent's series.
6. Solve Real and Complex integrals by using Cauchy Theorems.

UNIT - I

Fourier series: Definition of Periodic, Single valued, finite maxima and minima of functions. Euler's Formulae, Dirichlets Conditions for Fourier expansion, Functions having points of discontinuity, Change of interval, Expansion of odd and even functions, Half-range sine series and cosine series.

UNIT-II:

Partial differential equations: Formation of partial differential equations by eliminating the arbitrary constants or arbitrary functions, solutions of linear partial differential equation of first order by using Lagrange's Method, solution of Non-linear partial differential equations of first order by using standard types, Charpit's Method.

UNIT - III

Applications of Partial differential equations: Solution of partial differential equations by using method of separation of variables, solution of vibration of a stretched string (1D-Wave equation), one dimensional heat equation, Two dimensional heat equation under steady state conditions.

UNIT - IV

Theory of Complex variables: Analytic functions, Cauchy Riemann equations (Cartesian and polar forms), construction of Analytic functions by using Milne-Thomson's method. Harmonic function. Complex line integrals, Cauchy's theorem, Cauchy's Integral formula and its derivatives and problems related to the above theorems.

UNIT - V

Expansion of functions, Singularities & Residues: Taylor's and Laurent's series Expansions (Only statements). Zeros, types of singularities, Residues and Cauchy's Residue theorem, Evaluation of real integrals by Cauchy's residue theorem. Evaluation of Improper real integrals of the type: $\int_{-\infty}^{\infty} f(x)dx$ Where f(x) has no poles on real axis and $\int_{0}^{2\pi} f(\sin\theta, \cos\theta)d\theta$

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2015.
2. M.D. Raisinghania, "Advanced Differential equations", 7th edition, S Chand publishers, 2013.
3. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7th edition, McGraw Hill publishers, 2003.

Suggested Reading:

1. N P Bali and Manish Goyal, "A Text Book of Engineering Mathematics", 9th Edition, Laxmi publishers, 2016.
2. Alan Jeffrey, "Mathematics for Engineers and Scientists", 6th Edition, Chapman & Hall/CRC publishers, 2013.
3. A R Vasistha and R K Gupta, , "Integral transforms", Krishna prakashan publishers, 2004.
4. R.K.Jain & S.R.K.Iyenger, "Advanced Engineering Mathematics", 3rd edition, Narosa Publications, 2007.

16MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

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

Course Objectives: The Objectives of the course are:

1. to introduce managerial economics and demonstrate its importance in managerial decision making.
2. to develop an understanding of demand and relevance of its forecasting in the business.
3. to provide the basics of market structure and the concept of equilibrium in different market structures.
4. to examine the economic analysis of production process, types of inputs and to explain different costs and their relationship with the output.
5. to understand the importance of project evaluation in achieving a firm's objective.
6. to explain the concept of Accountancy and provided knowledge on preparation and analysis of Final accounts.

Course Outcomes: After completion of the 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. understand price determination for different markets.
4. study production theory and analyze various costs & benefits involved in it so as to make best use of resources available.
5. analyze different opportunities and come out with best feasible capital investment decisions.
6. apply accountancy concepts and conventions, Final accounts and financial analysis.

UNIT-I:

Introduction to Managerial Economics

Introduction to Economics and its evolution - Managerial Economics - its scope, importance, Its usefulness to engineers - Basic concepts of Managerial economics.

UNIT-II:

Demand Analysis

Demand Analysis - Concept of demand, determinants, Law of demand, its assumptions, Elasticity of demand, price, income and cross elasticity, Demand Forecasting - Types of Market structures. (Simple numerical problems).

UNIT-III:

Production and Cost Analysis

Theory of Production - Firm and Industry - Production function - input-out relations - laws of returns - internal and external economies of scale. Cost Analysis: Cost concepts - fixed and variable costs - explicit and implicit costs - out of pocket costs and imputed costs - Opportunity cost - Cost output relationship - Break-even analysis. (Theory and problems).

UNIT-IV:

Accountancy

Book-keeping, principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments.

UNIT-V:

Capital Budgeting

Introduction to capital budgeting, Methods: traditional and discounted cash flow methods. Introduction to Working capital management. (Numerical problems).

Text Books:

1. Mehta P.L., "Managerial Economics - Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2013.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 2013.
3. Panday I.M. "Financial Management", Vikas Publishing House, 11th edition, 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.

16CE C07

SURVEYING LAB - I

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 know the use of simple survey instruments in the field.
2. To develop topo maps from the field data.
3. To be in a position to choose the appropriate methods for the solution of field problems.
4. To be in a position to obtain data precisely.
5. To know how to create north and mark in the field and use it for obtaining bearings.

Course Out comes : At the end of the course the student should have learnt

1. To locate the objects, measure the distances and areas and transfer the same on to the drawings.
2. To suggest suitable solution for practical field problems such as two point and three point problems.
3. To develop L.S and C.S for road works, Canal works, using Auto levels.
4. To attain skill and expertise in traversing works using Theodolite by various methods.
5. To understand and apply the necessary checks and practicing to choose appropriate method for balancing a traverse.

<u>LIST OF EXPERIMENTS</u>

1. Practicing of direct and indirect ranging and measuring the distance using Chains and tapes.
2. Location of objects using a chain and tape and plotting the same.
3. Use of prismatic compass for measuring the area of a given land.
4. Introduction to plane table work. - Radiation and inter section methods.
5. Solution to resection by Two point problem.
6. Solution to resection by Three point problem using trial and error method and tracing paper methods.
7. Introduction to levelling - Fly levelling using Dumppy level.
8. Development of L.S. and C.S after obtaining levels by using Auto levels.

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9. Measurement of horizontal angles by Repetition method using Theodolite.
10. Measurement of horizontal angles by Reiteration method using theodolite.
11. Traversing by theodolite and balancing of traverse.

Suggested Readings:

1. C. Venkata Ramaiah, "A Text book of Surveying", University press, Hyderabad, 1997.
2. B.C. Punmia "Surveying vol. I and II", Laxmi Publications, 1994.

16CE C08

ENGINEERING GEOLOGY 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 enable the student understand the properties of minerals and characteristics of various rocks.
2. To enable the student study various structural models of rocks and understand the concepts of folds, faculty and unconformities.
3. To enable understand the electrical resistivity behaviour of rocks, soils and waters.
4. To enable the student know the distribution of building stones across India.
5. To enable the student understand the geological, geomorphologial and seismo ectonic aspects of the state and the country.

Course Out comes : At the end of the course the student should have learnt

1. To identify various types of minerals and rocks by their properties and characteristics.
2. To identify the folds, faults and unconformities in rocks and suggest necessary steps.
3. To suggest suitable measures before the construction of important structures like Dams, Bridges, Nuclear power plants, Sky scrapers across India, giving due reference to the distribution of various foundation rocks of that part of India.
4. To suggest on the ground water aspects, keeping in view the electrical resistivity aspects of soil/rock in that locality.
5. To contribute for the prediction of earthquakes, with the knowledge of seismo tectonic aspects of the country.

LIST OF EXPERIMENTS

1. Identification and Description of physical properties of minerals.
2. Identification and Description of Geotechnical characteristics of Rocks IS code:123(1975).
3. Determination of Apparent Specific gravity and Porosity and Water Absorption of different Rocks IS Code: 1124 (1974).
4. Study of Structural Models (folds, faults and unconformities).

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5. Measurement of strike and dip of joints in granites using clinometer Compass- a field experiment.
6. Measurement of Electrical Resistivity of rocks, Soils and waters - a lab. Expt.
7. Vertical Electrical sounding - a filed Expt.
8. Study of Geological Maps of Andhra Pradesh and India w.r.t. the distribution of Building Stones.
9. Study of Geological Map of India and Geomorphologic Map of India.
10. Study of Hydro geological Maps of Andhra Pradesh and India.
11. Study of tectonic Map of India, Seismo tectonic Atlas of India and Seismic Zoning Map of India.
12. Study of Maps and Sections pertaining to the Foundation Geology of Major Dam sites of India.
13. Study of Topographic maps.
14. Study of maps showing geological consideration of dams, Bridges, nuclear power plants, sky scrapers.

Suggested Reading:

1. Parbin singh, "A Text Book of Engineering and General Geology", Eighth revised edition, S.K. Kataria & Sonce, 2010.
2. Chenna Kesavulu.N, "A Text Book of Engineering Geology", Macmillan, 2004.
3. Dugal S.K etal.,"Engineering Geology",McGraw Hill Education(India) (P)Ltd. 2014.

16CE C09

COMPUTER AIDED CIVIL ENGINEERING DRAFTING 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 enable the student learn the fundamentals of computer aided drafting.
2. To enable the student create Civil Engineering drawings such as plans and elevations of buildings.
3. To enable to student learn different styles of defining such as tests, icons, insertion of building elements etc.
4. To enable the student learn the aspects of dimensioning, hatching etc.
5. To enable the students to develop survey maps using different features in CAD.

Course Out comes : At the end of the course the student should have learnt

1. To use basic drafting tools and create Civil Engineering drawings.
2. To adopt different commands in creation of objects.
3. To acquaint various techniques for faster implementation with different combinations of commands.
4. To improve the presentation of the drawing by using defining tools, dimensioning, hatching etc.
5. To draw detailed schemes and working drawings up to 2-D single storey buildings.

LIST OF EXPERIMENTS

1. **CAD :** Introduction to Computer Aided Drafting - features and Environment.
2. **Coordinates and Basic Drafting Tools:** Exercises pertaining to basic building elements to illustrate use of absolute coordinates, relative Cartesian coordinates. Object tools, such as SNAP and GRID.
3. **Display Commands:** Drawing Scale & View magnification, zooming and panning Commands.

4. **Creating and Editing 2D Geometry:** Creating LINE objects, creating CIRCLE, ARC, ELLIPSE and VARIUOS POLYGONS. Introduction to POLYLINE. Use of editing and modifying commands.
5. **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 Significance of Layers and its applications in building drawing - Use of different types of lines and their weightages.
7. **Creating Text and Defining Styles:** Exercises in adding text to the drawing. Management of text styles.
8. **Introduction to Blocks:** Significance of blocks in drawing - creating blocks of common building elements and their insertion.
9. **Dimensions and Hatching:** Addition of dimensions to the drawing - Dimension style management - Hatching of sections - styles of hatch.
10. 2-D Single story building plan.

Suggested Reading:

1. M.G. Shah, C.M. Kale and S.Y. Patki, Building Drawing , Tata Mc Graw-Hill Book Co., 2002.
2. Mastering Autocad, BPB Publications, 2000.
3. A. Balagopal and T.S. Prabhu, Building Drawing and Detailing, Spades publishers, Calicut, 1987.

16CE C10

TRANSPORTATION ENGINEERING

Instruction	4 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 student

1. 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. 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. Know the requirements for designing the railway tracks and the material required for the construction of permanent way.
5. Get an idea for the planning of airports and fixing of run way orientation and also applying the various corrections.

Course Outcomes: At the end of the course, the student

1. Know how to apply various IRC Standards for the Geometric design of highways.
2. Applies the Pavement design concepts to different types of pavement and analyze the collected field data and carries out the process for design of traffic management techniques.
3. Takes precautions required for the execution of construction of pavements and applies relevant IRC standards.
4. Is able to apply the design concepts of super elevation of railway curves and knows the requirements for the permanent way.
5. Knows how to select a site for airport construction and also knows how to fix the run way orientation and the circumstances in which the corrections to the run way length are to be applied.

UNIT-I:

Highway alignment and geometric design: History of highway engineering, factors to be considered for highway alignment, engineering surveys, obligatory points. Geometric design - Highways classification as per IRC and its standard dimensions, carriageway, shoulders, medians, right of way, footpaths, cycle tracks, service roads, frontage roads, sight distance, stopping sight distance, overtaking sight distance. Camber,

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horizontal curves, super-elevation, transition curve, extra widening, gradient, grade compensation and design of vertical curves.

UNIT- II:

Traffic engineering: Objectives of traffic studies, traffic characteristics, volume, speed, density, headways and relationship among them. Traffic volume studies, speed and delay studies, intersection delay studies, highway capacity and level of service concept as per HCM 2000, origin and destination studies, intersection improvement studies at grade, need of grade separated intersections, channelization, rotary planning and design, concept of signal design, parking and accident studies.

UNIT-III:

Highway materials & 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, vehicle damage factor, design by CBR developed by US corps of engineers, IRC cumulative standard axles method (IRC - 37: 2013). Rigid pavement design - concept, wheel load stresses analysis by Westergaard. Sub-grade, dry lean concrete, radius of relative stiffness. Modulus of sub grade reaction and other characteristics of concrete, critical wheel load and temperature stresses. Longitudinal and transverse joints, contraction joints, expansion joints, construction joints, dowel bars and tie bars functions.

UNIT-IV:

Railway Engineering: Introduction to Railways, permanent way component parts and its functions. Rails - various types, functions, creep in rails, creep measurement, coning of wheels and rail fixations. Sleepers - various types. merits and demerits, ballast, various types and sub grade preparation. Railway alignment and geometric design - alignment. super-elevation, negative super elevation, cant deficiency. Example problems. Points and crossing. Layout of left and right hand turnouts. Construction and maintenance of permanent way.

UNIT -V:

Airport engineering: Introduction to air transportation, history and international organizations role in development of airports, air craft types and its characteristics. General lay-out of an airport and its component parts. Site selection of an airport as per ICAO, orientation of runway by wind rose diagrams, basic runway length determination, corrections to basic runway length, geometric design, types of airports as per landing & take-off and dimensions.

Text Books:

1. Khanna. S. K. and Justo, C. E. G (1994), "Highway Engineering", Nemchand& Bros, New Delhi. India.
2. Khanna. S. K. Arora, M. G. and Jain. S. S. (1994) "Airport Planning and Design" Fifth edition. Nem Chand & Bros, Roorkee, India.
3. Chandra, S and Agarwal, M. M. (2007) "Railway Engineering" Oxford Higher Education, University Press New Delhi.

Suggested Reading:

1. McShane, W.R., Roess, R.P. and Prassas, E.S., Traffic Engineering. Prentice Hall. Englewood Cliffs, 1997.
2. Yang, H. and Huang., "Pavement Analysis and Design", Prentice Hall India Ltd-2004.
3. "Highway Capacity Manual", Transportation Research Board, National Research Council. Washington, D.C., 2000.
4. Saxena. S.C and Arora. S, "Text book of railway Engineering" DhanpatRai and Sons. 1988.
5. Relevant IRC codes.

16CE C11

CONSTRUCTION MANAGEMENT AND ADMINISTRATION

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

Course Objectives: To make the student

1. Understand the significance & aspects of construction management, and principles & types of organization.
2. Understand various planning & controlling tools like bar charts, and network techniques for solving construction problems.
3. Acquire knowledge about Network planning, Project updation &Time-cost analysis.
4. Familiar with construction contracts, project delivery methods, construction safety and laws applicable to construction Industry in India.
5. Understand optimization techniques for decision-making in construction Industry.

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

1. Successfully apply management skills in positions within the construction industry.
2. Apply technical skills and knowledge in construction, and technology in support of planning, analyzing, and solving construction problems.
3. Apply professional and ethical standards of behavior in dealing with all stakeholders to manage a quality construction project from start to completion, while maintaining budget, time - schedule, quality and safety requirements.
4. Put in efforts to manage the construction sites accident-free as far as possible and deal with contract management and untoward incidents at construction site efficiently.
5. Apply optimization techniques to decision-making scenarios in professional endeavours.

UNIT-I

Significance of construction management: objectives and functions of construction management, construction management team, principles of organization, types of organization.

UNIT-II

Construction Planning: Large scale production, economics of large scale production. Construction planning, bar charts, network techniques in construction management, CPM and PERT.

UNIT-III

Time Cost Analysis: Cost time analysis in network planning, updating, simple problems of civil engineering works.

Time estimate: expected likely, pessimistic and optimistic time, normal distribution curve and network problems.

UNIT-IV

Contracts: Introduction, types of construction contracts and their advantages and disadvantages, conditions of contracts, safety in safety in construction and safety measures, workmen compensation act, contract labour act. Demolition of Buildings. Tender: Tender form, Tender Documents, Tender Notice, Work Order.

Project Delivery Methods: BOT, SBOO, BOOT; Public Private Partership (PPP), Detailed Report (DPR).

UNIT-V

Optimization: Optimization through linear programming, need for linear programming, linear programming model, graphical method, simplex method and linear programming in construction.

Text Books :

1. Gahlot P.S. and Dhir. B.M., Construction Planning and Management, Wiley Eastern LTd., 1992.
2. Punmia B.C. and Khandelwal, PERT and CPM, Lakshmi Publications 1990.

Suggested Reading:

1. Seetharaman, "Construction Engineering and Management, 4^{th} Edition, Umesh Publications, New Delhi, 1999.
2. Srinath L.S., PERT and CPM: Principles and Application, East West Press, 1975.
3. Mahesh Varma, Construction Planning and Equipment, Metropolitan Book Co. Pvt. LTd., 1985.
4. Taha H., Opeartions Research, Wiley Int., 2002.
5. Gupta .V.K, "Operations Research", S.Chand Publications, 2008.

16CE C12

WATER AND WASTE WATER ENGINEERING

Instruction	4 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 student

1. Know how to forecast future population to estimate water demand of any community and also to calculate the head losses in the distribution pipe network analysis.
2. Know the design aspects of sedimentation tanks, clariflocculators and sand filters.
3. Estimate storm water and sewage quantity and design the hydraulics of sewers .
4. Design waste water treatment units in a sewage treatment plant.
5. Study the different sludge disposal methods available and to know about the solid waste management in India and its drawbacks.

Course Outcomes: At the end of the course, the student should have learnt

1. To design the water distribution system based on the population forecast.
2. To design various units of a WTP.
3. To apply the concepts of BOD, COD and TOC in sewerage systems and design of sewers.
4. To design the various treatment units in waste water treatment plant.
5. About solid waste management in India and low cost treatment technologies.

UNIT-I

Introduction: Necessity of protected water supply and sanitation. Water demand and per capita consumption, factors affecting population forecasts.
Water supply: Sources of water and quality parameters, standards of potable water, infiltration pipes & galleries, intake structures pipes, joints, valves & pumps. Water distribution systems and solution of a simple network using Hardy Cross method.

UNIT-II

Treatment of water: Clarification, sedimentation - Principles. Design of sedimentation tanks, coagu1ation and flocculation, design of a clariflocculator. Filtration - Types of filters and filter media. Design principles of slow and rapid sand filters. Backwash mechanisms. Pressure filters. Disinfections - Necessity and methods, Chlorination of water supplied, action of chlorine, break point chlorination. Ozone and U-V radiations, Removal of hardness, tastes &odour control.

UNIT - III

Domestic sewage: Quantity estimation, quality parameters - BOD, COD and TOC. Sewerage systems, ultimate disposal of sewage. Land and water bodies. Sewage conveyance - Sewer types and appurtenances. Velocity in sewers, Design of a simple sewerage system. Storm water sewers - Storm water estimation by rational method.

UNIT-IV

Waste water treatment: Preliminary treatment, screens, grit chambers. Primary treatment - Sedimentation - rectangular and circular sedimentation tanks. Secondary treatment - sewage filtration - trickling filter design. Activated sludge process - design parameters, secondary clarifier. Design aspects of a sewage treatment facility.

UNIT - V

Sludge: Sludge digestion and disposal methods - septic tanks- design parameters and working principles. Low cost waste treatment - oxidation ponds, Aerated Lagoons.

Solid waste: - Types, source and composition of solid waste. Methods of collection, separation transportation and disposal.

Text Books:

1. G.S. Birdi, Water Supply and Sanitary Engineering, DhanpatRai& Sons; 2002.
2. Garg, S.K., "Environmental Engineering Vol. I & II", Khanna Publishers, New Delhi, 1994.

Suggested Reading:

1. Peavy H.S, Rowe D.R and Tchobanoglous G, ""Environmental Engineering " Tata McGraw Hill Publications, New Delhi, 1985.
2. G.M. Fair, J.C. Geyer and D. Okun, "Water and waste Engineering", vol. II, John Wiley & sons, Inc., New York. 1968.
3. Metcalf & Eddy, M.C. "Wastewater Engineering - Treatment & Reuse", Tata McGraw Hill, Publications, New Delhi, 2003.

16CE C13

STRENGTH OF MATERIALS - 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

1. Study the basic concept of deflections of beams using various methods.
2. Draw SFD & BMD for indeterminate beams.
3. Understand the behavior of circular shafts subjected to torsion and also combined bending and torsion; compute the strain energy of members subjected to axial loads, shear, bending and torsion.
4. Know the theory and practical applications of springs and also to understand the failure behavior of columns & struts.
5. Know the concept of unsymmetrical bending and shear centre for different members.

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

1. Compute deflections in various types of beams under-various types of static loads, using various methods.
2. Determine the moments and shears in indeterminate beams under various types of loadings.
3. Determine the torsional strength of structural members and also to design them to resist a given torque; also to compute strain energy in member under various loading situations.
4. Design various types of springs and also columns & struts.
5. Evaluate the behavior of members under unsymmetrical bending and locate shear centres for different section.

UNIT-I

Slopes and Deflections: Slope and deflections by double integration method and Macalay's Method for cantilever, simple supported beams and overhanging beams carrying point loads, uniformly distributed loads, uniformly varying loads and couples. Moment area method and Conjugate beam method.

UNIT-II

Propped Cantilevers : Cantilever beams on elastic and rigid props for point loads and uniformly distributed loads. Shear force, bending moment diagrams, deflections.

Fixed beams: Analysis of fixed beam & sketching of BMD & SFD , slope and deflections in fixed beams with and without sinking of supports for point loads, uniformly distributed loads, uniformly varying loads.
Continuous beams: Theorem of three moments (Clapyron's theorem) & Analysis of continuous beams with and without sinking of supports by theorem of three moments. Shear force and bending moment diagrams.

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 stress. Equivalent B.M. and Equivalent T.M.

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, Close and open coiled helical springs under axial load and axial twist. Carriage springs.

Columns and Struts: Emperical 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, shear center locating 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, Hyd 1999.
3. E.P. Popov, Engineering Mechanics of solids, 1993.
4. G.H. Ryder, Strength of Materials, 3rd Edition in SI units, Macmillan India Ltd, Delhi, 2012.
5. A.Pytel and F.L.Singer, Strength of Materials , Harper & Row , 4th Edition, New York.1987.

16CE C14

FLUID MECHANICS - 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 understand fluid properties, fluid pressure & forces, basic concepts and continuity equation.
2. To understand the fluid motion, energy equation, analyze the forces on various objects.
3. To know various measuring instruments in finding the fluid pressure, velocity, and discharge.
4. To understand and analyze different flow characteristics of laminar and turbulent flows.
5. To study the motion of compressible flows and it's behaviour with different processes.

Course Outcomes: At the end of the course, the student should have learnt

1. To evaluate the various properties of fluid, analyse fluid flow and forces.
2. To apply the various laws and principles governing fluid flow to practical problems.
3. To measure pressure, velocity and Discharge of fluid flow in pipes, channels, and tanks.
4. To apply laws related to laminar and turbulent flow in pipes.
5. To evaluate compressibility of gases and its behaviour, apply energy & continuity equation.

UNIT-I

Fluid Properties and Kinematics: Definition of fluid, Properties of fluids-Density, specific Weight, Specific volume, Specific Gravity, Bulk Modulus, Vapour pressure, Viscosity and Surface tension, Newton's law of Viscosity and its application. Capillarity.

Fluid Statics: Pascal's Hydrostatic Law, Absolute and gauge pressure. Forces on immersed bodies:
Total pressure, center of pressure, pressure on curved surface.
Buoyancy: Buoyancy, Metacentre, stability of submerged and floating bodies.

Fluid Kinematics: Classification of fluid flow- steady unsteady, uniform, non uniform, one, two and three dimensional flows. Concept of streamline, stream tube, path line and streak line. Law of mass conservation - continuity equation from control volume and system analysis. Rotational and Irrotational flows, Stream function, Velocity potential function. Significance and use of flownets.

UNIT-II

Fluid Dynamics: Convective and local acceleration, body forces and surface forces, Eulers equation of motion from control volume and system analysis.

Law of energy conservation : Bernoulli's equation from integration of the Euler's equation. Signification of the Bernoulli's equation, its limitations, modifications and application to real fluid flows.

Impulse momentum equation: Momentum Correction factor. Impact of Jets, force exerted on flat and curved vane. Application of the impulse momentum equation to evaluate forces on nozzles and bends. Pressure on curved surface- vortex flow- forced and free vortex.

UNIT-III

Measurement of Pressure: Piezometer sand Manometers- Micro manometer- Bourdon Gauge, Transducers.

Measurement of Velocity: Pitoto tube, pitot static tube, Current meter and Hot-wire anemometer.

Measurement of Discharge in pipes and tanks: Venture meter, Orifice meter, nozzle meter, elbow meter and rotameter. Flow through mouthpiece and orifice.

Measure of Discharge in Free surface flows: Notches and weirs.

UNIT-IV

Compressive Flow: compressibility of liquids and gases. Continuity equation, Bernoulli's energy equation (for isothermal and adiabatic processes) and impulse momentum equation. Velocity of a pressure wave for adiabatic and isothermal processes. Mach number and Mach cone and its applications. Stagnation Pressure, Density and Temperature in adiabatic process.

UNIT-V

Flow through pressure conduits: Reynold's Experiment and its signification. Upper. Lower Critical Reynold's Numbers, Critical velocity. Hydraulic gradient. Laminar flow through circular pipes. Hagen Poiseuille equation. Turbulent flow characteristics. Ehadloss through pipes. Darcy-Weisbach equation. Friction factor. Moody's diagram. Minor loss, Pipes in Series and Pipes in parallel.

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Text Book:

1. P.N.Modi & S.M.Sethi, Hydraulic and Fluid Mechanics, Standard Book House, Delhi, 11th Edition, 1995.
2. A.K.Jain, Fluid Mechanics, Khanna Publishers, Delhi, 1993.

Suggested Books:

1. K.L. Kumar, Engineering Fluid Mechanics, Eurasia Publishing House, 1997.
2. R.K. Rajpur, Fluid Mechanics and Hydraulic Machines, S.Chand and Company, 2003.
3. Yunus A. Cengel & John M. Cimbla, Fluid Mechanics Fundamentals and Applications, Tata MsGraw Hill Education private Ltd, 2012.

16CE C15

STRENGTH OF MATERIALS 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 know and understand the experiments on various materials to assess their behavior / limitations.
2. To know the brittle and ductile material failure patterns etc., by conducting experiments.
3. To assess the hardness property of engineering materials.
4. To understand the shear force, bending moments and deflections for different types of beams.
5. To know rigidity modulus by conducting spring and torsion test.

Course Outcomes: At the end of the course, the student should have learnt

1. To compute the strength of members of various materials under different structural actions such as compression, tension, flexure and torsion.
2. To compute the elastic property of the material of beams by measuring deflections in beams and using the relations between load and deflection for various type of beams.
3. To determine the hardness of different types of materials.
4. To study the load-deflection behaviour for various types of springs.
5. To study the Torque-Twist behaviour of a given shaft.

LIST OF EXPERIMENTS

1. Direct Tension test on metal rods.
2. Young's Modulus of metal specimen by direct Tension test.
3. Brinnel's and Rock well hardness test.
4. Compression test.
5. Impact test.
6. Test on helical Spring to determine the rigidity modulus.
7. Torsion Test to determine the rigidity modulus of a shaft.
8. Deflection test on a cantilever beam to determine the Young's modulus.
9. Deflection test on a simple beam to determine the Young's Modulus.

10. Deflection test on a Fixed beam to determine the Young's Modulus.
11. Deflection test on a Continuous beam to determine the Young's Modulus.

Suggested Readings:

1. B.C.Punmia , Strength of Materials, Laxmi publishers, Delhi, 2011.
2. S.Ramamrutham, Strength of Materials, Dhanpat Rai & Sons, Delhi, 2012.
3. G.H. Ryder, Strength of Materials, 3rd Edition in SI units, Macmillan India Ltd,

16CE C16

SURVEYING -II 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 importance of vertical angles for finding the heights and distances.
2. To get exposure to modern instruments for solving the problems and also understanding the concepts of automation in surveying.
3. To be in a position to set the curves by using various methods and identifying the data required to be computed for the same.
4. To get an idea about developing drawings based on field data.
5. To get an idea about the data transferring to field from the developed maps.

Course Outcomes :

1. To Find the Reduced level of a given point in different practical situations.
2. To determine the area of a given topography using principles of Tachometry.
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. Finding the R.L. of a given point using two instrument stations in the same vertical plane as that of the point when the base of the point is inaccessible.
2. Finding the difference of level between two given points using two theodilite stations (Baseline) in different planes.
3. Determination of Tacheometer constants and finding the area by using stadia tacheometer.
4. Finding the gradient of a line connecting two points using stadia tacheometry .
5. Locating ground details using Total Station and plotting the same.
6. Staking of points for a foundation or a Road centre line or a pipe line using Total station.

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7. Setting of simple curve with the help of Total Station by coordinate system .
8. Location of Ground features using GPS instrument and plotting the same after processing the data.
9. Developing contour maps for a land using modern instruments.

Suggested Readings:

1. C. Venkata Ramaiah, "A Text book of Surveying", University press, Hyderabad, 1997.
2. B.C. Punmia, "Surveying Vol. I and II", Laxmi publications, 1994.

16EG CO3

SOFT SKILLS AND EMPLOYABILITY ENHANCEMENT 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: To help the students

1. Participate in group discussions and case studies with confidence and to make effective presentations. Also to learn the art of communication.
2. With- resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management & goal setting, self confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.
5. To understand the elements of research and hone their soft skills through a live, mini project.

Course Outcomes: The 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 mange 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

Group Discussion and Case studies: Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Elements of effective presentation, Structure of presentation, Presentation tools, Body language, Creating an effective PPT.

Exercise 2

Interview Skills: Resume writing, structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets.

Interview Skills: Concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews.

Exercise 3

Personality Development: Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.

Exercise 4

Corporate Culture: Grooming and etiquette, communication media etiquette, Academic ethics and integrity.

Exercise 5

Mini Project: General/Technical Research, developing a questionnaire, data collection, analysis, written report and project seminar.

Suggested Reading:

1. Dr. Shalini Verma, Body Language- Your Success Mantra, S Chand, 2006.
2. Ramesh, Gopalswamy, and Mahadevan Ramesh, The ACE of Soft Skills, New Delhi: Pearson, 2010.
3. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989.

16CE C17

Mini Project -Survey Camp

Instruction	6 days (36 hrs) between IV Semester to V Semester
Duration of Semester End Examination	-
Semester End Examination	-
CIE	50 Marks
Credits	1

A one week (6 days - 36 hours) surveying camp should be organized in the intervening period between the completion of the IV Semester and the commencement of V semester.

The work has to be graded for 50 Sessional marks by a committee consisting of the Head of the department and 2-3 Senior Faculty members.

The surveying camp should expose the student to all the aspects of planning, organizing and conducting a filed survey and plotting of the same.

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16CEC208 **PROJECT SEMINAR**

Instruction	3 periods per week
Sessional	50 Marks
No. of Credits	3

Each student will be attached to a faculty member, (guide) for Project Seminar during the Third Semester. The student will carry out the project which may be development of Software / Hardware / Simulation studies / Design / Analysis /Experimental related to his / her Specialization: The work will be monitored regularly by the guide. At the end of the Semester, student will write the report on the work done and submit to the guide. Student has to present his / her work before two faculty members (one guide and other to be appointed by Chairman BOS) on a fixed day during last week of the semester in which project seminar is offered. The sessional marks will be awarded jointly by these two examiners based on the report, the presentation and vica voce.

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16CEC209 **DISSERTATION (III & IV Sem)**

Instruction	
University Examination	Viva Voce
Marks	100+100
No. of Credits	12

***Excellent / Very Good / Good / Satisfactory / Unsatisfactory**