CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(Autonomous)

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

www.cbit.ac.in

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 2018 - 19 from S. No. 3516 – 3899

S.No	Course Name	Code
3516	Engg. Mathematics -I	18MT C02
3517	Biology-I	18BTC01
3518	Programming for Problem Solving	18CS C01
3519	English	18EG C01
3520	Programming for Problem Solving Lab	18CS C02
3521	Workshop/ Manufacturing Practice	18ME C02
3522	English Lab	18EG C02
3523	Engg. Mathematics -II	18MT C04
3524	Basics of Biology-II	18BT C02
3525	Engineering Mechanics	18CE C01
3526	Engineering Graphics and Design	18ME C01
3527	Basic Electrical Engineering	18EE C01
3528	Basic Electrical Engineering Lab	18EE C02
3529	Mathematics –III	16MT C06
3530	Process Principles and Reaction Engineering	16BT C05
3531	Biochemistry	16BT C06
3532	Cell Biology	16BT C07
3533	Microbiology	16BT C08
3534	Genetics	16BT C09
3535	Biochemistry Lab	16BT C10
3536	Microbiology Lab	16BT C11
3537	Soft Skills and Employability Enhancement Lab	16EG C03
3538	Chemical and Biochemical Thermodynamics	16BT C12
3539	Molecular Biology	16BT C13
3540	Immunology	16BT C14
3541	Instrumental Methods in Biotechnolgy	16BT C15
3542	Industrial Biotechnology	16BT C16
3543	Engineering Economics and Accountancy	16MB C01
3544	Immunology Lab	16BT C17
3545	Instrumental Methods in Biotechnology Lab	16BT C18

3546	Biostatistics	16MT C08
3547	Fluid Mechanics and Heat Transfer	16BT C19
3548	Protein Engineering and Enzyme Technology	16BT C20
3549	Genetic Engineering and rDNA Technology	16BT C21
3550	Environmental Biotechnology	16BT E22
3551	Food Biotechnology	16BT E23
3552	Computational Numerical Methods	16MT E02
3553	Python for Bioinformatics	18CS E02
3554	Virology	16BT E24
3555	Metabolic Engineering	16BT E25
3556	Fluid Mechanics and Heat Transfer Lab	16BT C26
3557	Enzyme Technology Lab	16BT C27
3558	Genetic Engineering Lab	16BT C28
3559	Fermentation Technology	16BT C29
3560	Mass Transfer Operations	16BT C30
3561	Bioinformatics	16BT C31
3562	JAVA Programming and Bio-Java	18CS E02
3563	Medical Biotechnology	16BT E32
3564	Phyto Chemicals and Herbal Products	16BT E33
3565	Developmental Biology	16BT E34
3566	Pharamceutical Biotechnology	16BT E35
3567	Bioprocess Economics & Plant Design	16BT E36
3568	Bioprocess Lab	16BT C37
3569	Mass Transfer Operations Lab	16BT C38
3570	Bioinformatics Lab	16BT C39
3571	Mini Project	16BT C40
3572	Downstream Processing	BT 411
3573	Bioprocess Dynamics and Control	BT 412
3574	Plant Biotechnology	BT 413
3575	Animal Biotechnology	BT 414
3576	Principles and Practice of Management	MB 216
3577	Developmental Biology	BT 461
3578	Cancer Biology	BT 462
3579	Genomics and Proteomics	BT 463
3580	Pharmaceutical Biotechnology	BT 464
3581	Downstream Processing Lab	BT 415
3582	Tissue culture Lab	BT 416
3583	Project Seminar	BT 417
3584	Bioprocess Economics and Plant Design	BT 422
3585	Molecular Modeling and Drug Design	BT 471
3586	Immunodiagnostics	BT 472
3587	Tissue Engineering	BT 473
3588	Bioprocess Validations and Current good manufacturing Practices	BT 481
3589	Food Biotechnology	BT 482
3590	Nanobiotechnology	BT 483
3591	Entrepreneurship	ME 464
3592	Seminar	BT 423

3593	Project	BT 901
3594	Discrete Mathematics	16MCC101
3595	Computer Programming and Problem Solving	16MCC102
3596	Elements Of Information Technology	16MCC103
3597	Managerial Economics and Financial Analysis	16MBC128
3598	Professional Communication in English	16EGC101
3599	Computer Programming Lab Using C	16MCC104
3600	Elements of Information Technology Lab	16MCC105
3601	Professional Communication Lab	16EGC102
3602	Object Oriented Programming(OOP)	16MCC106
3603	Computer Organization	16MCC107
3604	Software Engineering	16MCC108
3605	Data Structures Using C++	16MCC109
3606	Operations Research	16MCC110
3607	Probability and Statistics	16MTC102
3608	Object Oriented Programming Lab Using Java	16MCC111
3609	Data Structures Lab Using C++	16MCC112
3610	Database Management Systems	16MCC113
3611	Web Technologies	16MCC114
3612	Design and Analysis of Algorithms	16MCC115
3613	Operating Systems	16MCC116
3614	Database Management Systems Lab	16MCC117
3615	Web Technologies Lab	16MCC118
3616	Operating Systems Lab	16MCC119
3617	Organizational Behavior	16MBC04
3618	Disaster Mitigation and Management	16CE E21
3619	Computer Networks	16MCC120
3620	Data warehousing and Data Mining	16MCC121
3621	Advanced Java Programming	16MCC122
3622	Computer Networks Lab	16MCC123
3623	Data warehousing and Data Mining Lab	16MCC124
3624	Mini Projects	16MCC125
3625	Software Testing	16MCE102
3626	Artificial Neural Networks	16MCE103
3627	Cloud Computing	16MCE106
3628	Software Project Management	16MCE107
3629	Object Oriented System Development(OOSD)	16MCC126
3630	Machine Learning	16MCC127
3631	Cryptography & Network Security	16MCC128
3632	Object Oriented System Development Lab	16MCC129
3633	Machine Learning Lab using Python	16MCC130
3634	Seminar	16MCC131
3635	Internet of Things	16MCE110
3636	Business Intelligence and Analytics	16MC E111
3637	Big Data Analytics	16MC E113
3638	E-Commerce	16MC E114
3639	MAJOR PROJECT WORK	16MC C132

3640	Programming for problem solving	18CS C01
3641	Programming for Problem Solving Lab	18CS C02
3642	Object-Oriented Programming	18CS C03
3643	Object-Oriented Programming Lab	18CS C04
3644	Data Structures	16CSC03
3645	OOPS using java	16CSC04
3646	Logic and Switching Theory	16CSC05
3647	Discrete Structures	16CSC06
3648	Soft Skills Lab	16EGC03
3649	Data Structures Lab	16CSC07
3650	OOPS using java lab	16CSC08
3651	Mini Project-1	16CSC09
3652	Data Base Management Systems	16CS C10
3653	Web Technologies	16CS C11
3654	Computer Architecture and Micro Processors	16CS C12
3655	Probability and Statistics Using R	16CS C13
3656	Data Base Management Systems Lab	16CS C14
3657	Web Technologies Lab	16CS C15
3658	CA and MP Lab	16CS C16
3659	Linux Programming and Scripting Languages	16CS E01
3660	Principle of Programming Languages	16CS E03
3661	Design and Analysis of Algorithms	16CSC17
3662	Automata Languages and Computation	16CSC18
3663	Operating Systems	16CSC19
3664	Data Communication and Computer Networks	16CSC20
3665	Software Engineering	16CSC21
3666	Mobile Application Development(E-II)	16CSE04
3667	Computer Graphics(E-II)	16CSE05
3668	Operating Systems Lab	16CSC22
3669	Software Engineering Lab	16CSC24
3670	Data Communication and Computer Networks Lab	16CSC23
3671	Compiler Construction	16CSC25
3672	Artificial Intelligence	16CSC26
3673	Mobile Computing	16CSC27
3674	Information and Network Security	16CSC28
3675	Internet of Things	16CSC29
3676	Information and Network security Lab	16CSC30
3677	Internet of Things Lab	16CSC31
3678	Mini Project-II	16CSC32
3679	Computer Vision	16CSE07
3680	Soft Computing(E-I)	16CSE08
3681	Data Mining	16CSE09
3682	Artificial Intelligence	CS411
3683	Distributed Computing	CS412
3684	Data Mining	CS413
3685	OOSD	CS414
3686	Open Source Technologies	CS464

3687	DM lab	CS415
3688	OOSD lab	CS416
3689	Project Seminar	CS417
3690	Information and Network Security	CS 421
3691	Data Science and Big Data Analytics	CS 471
3692	Cloud Computing	CS 472
3693	Cyber Forensics	CS 474
3694	Software Reuse Techniques	CS 476
3695	Information and Network Security Lab	CS 483
3696	SEMINARS	CS 422
3697	PROJECTS	CS 423
3698	Advanced Algorithms	16CSC101
3699	Advanced Operating Systems	16CSC102
3700	Advanced Databases	16CSC103
3701	Elective 1 Data Mining	16CSE11X
3702	Elective 2 Internet of Things	16CSE12X
3703	Elective 3 Software Quality Assurance & Testing	16CSE13X
3704	ADB Lab (Lab-I)	16CSC104
3705	Seminar - I	16CSC105
3706	Soft Skills Lab	16EG104
3707	Advance Network Technologies	16CSC201
3708	Big Data Analytics	16CSC202
3709	Advanced Software Engineering	16CSC203
3710	Cloud Computing Elective-4	16CSE251
3711	Image Processing Elective-5	16CSE243
3712	Streaming Technologies Elective-6	16CSE263
3713	Big Data Analytics Lab	16CSC204
3714	Seminars-ii	16CSC205
3715	Mini Projects	16CSC206
3716	Project Seminar	16CSC301
3717	Project Work and Dissertation	16CSC401
3718	Mathematics -I	18MT C01
3719	Chemistry	18CY C01
3720	Engineering Mechanics	18CE C01
3721	Engineering Graphics and Design	18ME C01
3722	Programming for Problem Solving	18CS C01
3723	Programming for Problem Solving Lab	18CS C02
3724	Chemistry Lab	18CY CO2
3725	Mathematics - II	18MT C03
3726	Optics and Semiconductor Physics	18PY C01
3727	Object Oriented Programming Through C++	18ITC01
3728	English	18EG C01
3729	Optics and Semiconductor Physics Laboratory	18PY C02
3730	Object Oriented Programming Through C++	18IT C02
3731	Workshop/ Manufacturing Practice	18ME C02
3732	English Lab	18EG C02
3733	Engineering Mathematics-III	16MTC05

3734	Discrete Structures and Applications	16ITC01
3735	Data Structures and Algorithms	16ITC02
3736	Object Oriented Programming	16ITC03
3737	Digital Electronics & Logic Design	16ITC04
3738	Data Structures and Algorithms Lab	16IT C05
3739	Object Oriented Programming Lab	16IT C06
3740	Mini Project - I	16IT C07
3741	Soft Skills and Employability Enhancement Lab	16EGC03
3742	Design and Analysis of Algorithms	16ITC08
3743	Data Communications	16ITC09
3744	Java Programming	16ITC10
3745	Computer Organization and Microprocessors	16ITC11
3746	Fundamentals of Data Science	16ITC12
3747	Engineering Economics and Accountancy	16MBC01
3748	Java Programming Lab	16ITC13
3749	Microprocessors Lab	16ITC14
3750	Mini Project - II	16ITC15
3751	Principles of Operating Systems	16ITC16
3752	Database Systems	16ITC17
3753	Software Engineering	16ITC18
3754	Web Technology	16ITC19
3755	Theory of Automata	16ITC20
3756	Python Programming	16ITE01
3757	UNIX and Shell Programming	16ITE02
3758	Scripting Languages	16ITE03
3759	Operating Systems and Web Technology Lab	16ITC21
3760	Database Systems Lab	16ITC22
3761	Mini Project-III	16ITC23
3762	Computer Networks and Socket Programming	16ITC24
3763	Data Warehousing and Data Mining	16ITC25
3764	Artificial Intelligence	16ITC26
3765	Principles of Compiler Design	16ITC27
3766	Principles of Computer Graphics	16ITE04
3767	Object Oriented System Development using UML	16ITE06
3768	Digital Image Processing	16ITE07
3769	Information Retrieval Systems	16ITE08
3770	E-Commerce	16ITE09
3771	Network Programming Lab	16ITC28
3772	Data Mining Lab	16ITC29
3773	Mini Projects - IV	16ITC30
3774	Big Data Analytics	IT 411
3775	Mobile Computing	IT 412
3776	Distributed Systems	IT 413
3777	VLSI Technology	IT 414
3778	Disaster Mitigation and Management	CE 422
3779	Big Data Analytics Lab	IT 415
3780	VLSI Technology Lab	IT 416

3781	Project Seminar	IT 417
3782	Embedded Systems & Internet of Things	IT 421
3783	E-Commerce	IT 476
3784	Data Analysis using R programming	IT 477
3785	Entrepreneurship	ME 464
3786	Cloud Computing	IT 481
3787	Seminars	IT 423
3788	Embedded Systems & IOT Lab	IT 422
3789	Number Theory	16ITC101
3790	Advanced Computer Networks	16ITC102
3791	Cryptography and Network Security	16ITC103
3792	Distributed Systems	16ITE112
3793	Information Retrieval Systems	16ITE121
3794	E-Commerce	16ITE131
3795	Software Lab-I (Crptography and Network Security)	16ITC104
3796	Seminar-I	16ITC105
3797	Information Systems Security	16ITC201
3798	Big Data Analytics	16ITC202
3799	Advanced Computer Networks	16ITC102
3800	Machine Learning	16ITE122
3801	E- Commerce	16ITE133
3802	Web Mining	16ITE253
3803	Big Data Analytics Lab	16ICT204
3804	Seminar-II	16ITC205
3805	Mini Project	16ITC206
3806	Project Seminar	16ITC301
3807	Project Work and Dissertation	16ITC401
3808	Mathematics -I	18MTC01
3809	Waves, Optics and Introduction To Quantum Mechanics	18PYC04
3810	Programming for Problem Solving	18CSC01
3811	English	18EGC01
3812	Waves and Optics Laboratory	18PYC07
3813	Programming and Problem Solving Lab	18CSC02
3814	Workshop/Manufacturing Practice	18MEC02
3815	English Lab	18EGC02
3816	Mathematics -II	18MTC03
3817	Chemistry	18CYC01
3818	Engineering Mechanics	18CEC01
3819	Engineering Graphics and Design	18MEC01
3820	Basic Electrical Engineering	18EEC01
3821	Basic Electrical Engineering Lab	18EEC02
3822	Chemistry Lab	18CYC02
3823	Engineering Mathematics-III	16MT C05
3824	Electrical Circuits-I	16EE C02
3825	Electrical Measurements and Instruments	16EE C03
3826	Electronics Engineering	16EC C16
3827	Prime Movers and Pumps	16ME C11

3828	Engineering Economics and Accountancy	16MB C01
3829	Circuits and Measurements Lab	16EE C04
3830	Electronics Engineering Lab	16EC C17
3831	Prime Movers and Pumps Lab	16ME C12
3832	Electrical Circuits -II	16EEC06
3833	Electrical Machinery - I	16EEC07
3834	Power Systems - I	16EEC08
3835	Electromagnetic Theory	16EEC09
3836	Digital Electronics and Logic Design	16EEC10
3837	Linear Integrated Circuits	16EEC11
3838	Electrical Machinery - I Lab	16EE C12
3839	Linear Integrated Circuits Lab	16EE C13
3840	Soft Skills and Employability Enhancement Lab	16EG C03
3841	Power Systems – II	16EEC15
3842	Electrical Machinery – II	16EEC16
3843	Power Electronics	16EEC17
3844	Linear Control Systems	16EEC18
3845	Non Conventional Energy Sources	16EE E01
3846	Statistical and Numerical Methods	16MT E01
3847	Electrical Machinery – II Lab	16EEC19
3848	Power Electronics Lab	16EEC20
3849	Linear Control Systems Lab	16EEC21
3850	Electrical Machinery – III	16EEC23
3851	Switchgear and Protection	16EEC24
3852	Power Semiconductor Drives	16EEC25
3853	Microprocessor and Microcontrollers	16EEC26
3854	Artificial Intelligence Techniques in Electrical Engineering	16EEE06
3855	Optimization Techniques	16EEE08
3856	Advanced Control System	16EEE09
3857	High Voltage DC Transmission	16EEE11
3858	Simulation Techniques for Electrical Engineering	16EEE12
3859	Microprocessor and Microcontrollers Lab	16EEC27
3860	Power Systems Lab	16EEC28
3861	Mini Project	16EEC29
3862	Power System Operation & Control	EE 411
3863	Power Semiconductor Drives	EE 412
3864	HVDC & FACTS	EE 413
3865	Managerial Economics & Accountancyurse-4	MB214
3866	Entrepreneurship	ME 464
3867	Artificial Intelligence Techniques in Electrical Engineering	EE 462
3868	Technical Writing & Presentation Skills	EG 451
3869	Digital Signal Processing Lab	EE 414
3870	Power Systems Lab	EE 415
3871	Project Seminar	EE 416
3872	Utilization of Electrical Energy	EE 421
3873	Industrial Administration & Financial Management	ME419
3874	Power Quality Engineering	EE 474

3875	Electrical Distribution Systems	EE 475
3876	Disaster Mitigation & Management	CE 422
3877	Electrical Simulation Lab	EE 422
3878	General Seminar	EE 423
3879	Project	EE 901
3880	Power Semi-Conductor Devices & Circuits	16EEC101
3881	Distribution System Planning and Automation	16EEC102
3882	Flexible AC Transmission Systems	16EEC106
3883	Renewable Energy Sources	16EEE107
3884	Power Quality Engineering	16EEE109
3885	Energy Management	16EEE110
3886	Power Electronics Lab	16EEC108
3887	Seminar – I	16EEC109
3888	Soft Skills Lab	16 EG 104
3889	Advanced Computer Methods in Power Systems	16EEC103
3890	Power System Stability	16EEC104
3891	Advanced Electric Drives	16EEC105
3892	Deregulation of Power Systems	16EEE105
3893	HVDC Transmission	16EEE113
3894	Research Methodology & Professional Ethics	16EEE114
3895	Power Systems Lab	16EEC107
3896	Seminar – II	16EEC110
3897	Mini Project	16EEC111
3898	Project Seminar	16EEC101
3899	Project Work & Dissertation	16EEC103

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
B.Tech (Bio-Tech)

SEMESTER – I

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
	THEORY								
1	18MT C02 / 18BT C01	Engg. Mathematics - I/ Basics of Biology-I	3	1	-	3	30	70	4
2	18PY C05	Physics	3	1	-	3	30	70	4
3	18CS C01	Programming for Problem Solving	3	-	-	3	30	70	3
4	18EG C01	English	2	-	-	2	20	50	2
	PRACTICALS								
5	18PY C08	Physics Lab	-	-	3	3	25	50	1.5
6	18CS C02	Programming for Problem Solving Lab	-	-	4	3	25	50	2
7	18ME C02	Workshop/ Manufacturing Practice	1	-	4	3	25	50	3
8	18EG C02	English Lab	-	-	2	2	15	35	1
Total			**12**	**02**	**13**	**-**	**200**	**445**	**20.5**

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

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Y. Rajani

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Gandipet, Hyderabad-500 075.

18MT C02

ENGINEERING MATHEMATICS– I
(for BiPC Stream of Bio-Tech)

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

Course Objectives:

1. The purpose of E.T is to learn simple steps and its derivatives.
2. It is also essential to learn how to calculate steps, Evaluations and height of High tower buildings.
3. Limits, continuity and differentiability is very essential to function any system or organization.
4. To learn matrices is very important on day to day life in the form of Minimization or Maximization of price etc.
5. To assess the system of Thing for period of short time or long time the curve fitting is very useful.
6. These elementary operations are very important to grow further and achieve results in the form of Research and Development.

Course outcomes: On successful completion of this course the students shall be able to

1. Basics of elementary trigonometry is very essential to solve Engineering problems.
2. Very useful to find out Slopes, Heights and Distances.
3. Basics of limits, continuity and differentiability are must to develop the mathematical modelling.
4. Applications of matrices are abundantly used in Industry as well as Research and Development.
5. It is very useful to find constant co-efficient of straight line and curved equations by curve fitting methods and it uses are plenty at surveying agricultural fields.
6. It is for Research and Development.

UNIT-I :Trigonometry: Trigonometric ratios and compound angles, trigonometric ratios of multiple and sub multiple angles. Transformations-sum and product rules. Hyperbolic and Inverse Hyperbolic functions.

UNIT-II: Limits, Continuity: Intervals and neighbourhoods, limits and concept of a limit. Standard limits and related problems.

UNIT-III: Differentiation:Derivatives of a function, Elementary properties. Derivatives of Trigonometric, Inverse Trigonometric, Hyperbolic and inverse Hyperbolic functions. Methods of differentiation, second and higher order derivatives.

UNIT-IV: Matrices: Types of matrices, multiplication of matrices, scalar multiplication. Inverse of matrix-determinant, singular, non-singular, minor, cofactors, adjoint, Rank-Echelon form, consistency, inconsistency Solutions of simultaneous linear equations.

UNIT-V: Curve Fitting: Residues, Principle of Least squares and Curve fitting by the method of least squares, Fitting of a straight line, parabola, Fitting of the curves of the form $y = ab^x$, $y = ae^{bx}$.

Text Books:

1. Shanti Narayan and P.K. Mittal ,” Differential Calculus” , 30th edition, S. Chand publishers, 2005.
2. A.R.Vasistha, “Matrices” , 43rd edition, Krishna Prakashan Media (P) Ltd. 2014.
3. B.S.Grewal , “Numerical Methods for scientists and engineers” , 43rd Edition, Khanna Publishers, 2015.

Suggested Reading:

1. N P Bali and Manish Goyal, “A Text Book of Engineering Mathematics”, 9th Edition, Laxmi publishers, 2016.
2. Joseph Edwards, “Differential Calculus For Beginners”, Arihant publishers,2016.
3. KantiB.Datta, “Mathematical Methods of Science and Engineering”, CENGAGE Learning publishers, 2014.
4. S.S.Shastry, “Introductory Methods of Numerical Analysis”, 5thEdition, EEE publishers, 2014.

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18BT C01

BASICS OF BIOLOGY-I

(for MPC Stream of Bio-Tech)

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

Course Objectives:

1. To provide knowledge on basic concepts of Biology to mathematic background students.
2. To give understanding fundamentals of origin of life onwards and various theories of evolution.
3. To provide an insight into classification of plants and their propagation mode.
4. To give the students an understanding of knowledge on microbes and their economic importance.
5. To impart theoretical knowledge on various physiological aspects of plants.

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

1. Explain the theories behind the origin of life and evolution studies.
2. Classify plants based on the habit and habitat of plants.
3. Compare the mechanism of reproduction and development of seed in plants.
4. Outline and identify the basic structure and function of various organelles of plant cell.
5. Identify and classify microbes and compile the their economic importance.
6. Analyse basic physiological processes in plants.

UNIT-I
HISTORY OF LIFE AND EVOLUTION

History of earth, evolutionary concepts of origin of life. Experimental verification of chemical origin of life - Miller's Experiment. Darwinism, Natural selection, Sexual selection, Artificial selection, Mendelism, Hugo de Vries mutation theory, neo-darwinism.

UNIT-II
PLANT SYSTEMATIC AND REPRODUCTION

Plant kingdom, salient features of classification. Alternation of generation of the plants. Type studies of Algae (Spirogyra), Fungi (Rhizopus), Bryophytes (Pteris), Gymnosperms (Cycas) and general characteristics and life cycle of Angiosperms. Overview of modes of reproduction-Asexual: vegetative propagation, budding, sporulation, binary fission; Sexual reproduction: pollination, fertilization, development of embryo, endosperm, fruit and seed formation. Apomixes, pathenocarpy, polyembrony type of reproduction.

UNIT-III

CELL STRUCTURE AND INTERNAL ORGANIZATION OF PLANTS

Cell as basic unit of life, overview of the plant cell, cell cycle, cell division, mitosis and meiosis. Concept of Growth, meristems (apical, intercalary and lateral) their functions. Simple tissue (parenchyma, collenchyma and sclerenchyma), complex tissues (xylem and phloem). Tissue systems (epidermal, ground and vascular)

UNIT-IV

MICROBIOLOGY

Introduction and importance of classification – five kingdoms. General account of prokaryotes. Concept of species and strains. Sterilization and media compositions. bacterial viruses - T4, plant viruses – TMV, animal viruses – HIV, Protista, Fungi, Plantae and Animalia. Reproduction in bacteria (asexual - binary fission and sexual - conjugation) and viruses (lytic and lysogenic). Economic importance of beneficial bacteria (agriculture, industry, medicine and biotechnology).

UNIT-V

PLANT PHYSIOLOGY AND CONCEPTS IN PLANT BIOTECHNOLOGY

Absorption of water – soil water, water potential, diffusion, imbibitions, osmosis, plasmolysis, absorption of water, ascent of sap, transportation. Crop improvement - Heterosis and mutation breeding. Plant tissue culture techniques and their applications. Plant growth regulators.

Text Books:

1. Biology. Raven, Johnson, Losos, Mason, Singer. Tata Mc Graw Hill Publishing Co. Pvt. Ltd 9th edition, (2010).
2. Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P.V.; Jackson, R. B. Biology: A global approach: Pearson Education Ltd (2014).

Suggested Reading:

1. Stent GS and Calender,RWH, Molecular Genetics (2nd Edition) Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher.
2. Prescott, LM . Harley JP and Klein CA, , Microbiology, 1995 2nd Edition , Wm, C Brown Publishers.
3. Beginning Science: Biology. B.S. Beckett. Oxford University Press.1 st edition, 1983.

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18PY C05

PHYSICS

(for Chemical and Bio-Tech)

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

Course Objectives:

The objectives of the course is to make the student

1. Learns the basic concepts of wave nature of light and acquires knowledge of lasers and fibre optics.
2. Understands the general concepts of electromagnetism.
3. Familiar with fundamental ideas of Quantum Mechanics.

Course Outcomes:

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

1. Demonstrate the wave nature of the light and describe the types of lasers. and optical fibres and their applications.
2. Develop the concepts related to electromagnetic behavior.
3. Demonstrate the important concepts of Quantum Mechanics.

UNIT-I: Optics

Diffraction: Introduction to interference and example; concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits;diffraction grating, characteristics of diffraction grating and its applications.

Polarisation: Introduction, polarisation by reflection, polarisation by double refraction, scattering of light, circular and elliptical polarisation, optical activity.

UNIT-II: Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with opticalfibres, step and graded index fibres, pulse dispersion, applications of optical fibres.

UNIT-III: Lasers: Introduction to interaction of radiation with matter, principles and working of laser: population inversion, pumping, various modes, threshold population inversion,types of laser: solid state, semiconductor and gas; applications of lasers.

UNIT-IV: Electromagnetism and Magnetic Properties of Materials:

Laws of electrostatics, electric current and the continuity equation, laws of magnetism. Ampere's Faraday's laws. Maxwell's equations. Polarisation, permeability and dielectricconstant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossottiequation, applications of dielectrics.Magnetisation, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

UNIT-V: Quantum Mechanics:

Introduction to quantum physics, black body radiation, explanation using the photon concept, photoelectric effect, Compton effect, de Broglie hypothesis, wave-particle duality, Born's interpretation of the wave function, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box

TEXT BOOKS:

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

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, 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 Limited; 6th Revised edition, 2015.

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18CS C01

PROGRAMMING FOR PROBLEM SOLVING
(Common to All Programs)

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

Course Objectives

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

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

1. Identify the computing environments.
2. Formulate solutions to problems and represent them using algorithms/ Flowcharts.
3. Choose proper control statements and data structures to implement the algorithms.
4. Trace the programs with test the program solution.
5. Decompose a problem into modules and use functions to implement the modules.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping and nested statements.

Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes.

Case study:

UNIT – III

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting(selection and Buble) algorithms, 2-D arrays, matrix operations.

Strings: Introduction, stringsrepresentation, string operations with examples.

Case study:

UNIT – IV

Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, function pointers, array of function pointers, dynamic memory allocation, advantages and drawbacks of pointers.

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions and enumerated data types.

UNIT-V

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

Preprocessor Directives: Types of preprocessor directives, examples.

Suggested Reading:

1. A K Sharma "**Computer Fundamentals and Programming**", 2nd Edition, University Press, 2018.
2. PradeepDey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017.

References:

1. Byron Gottfried, Schaum's"**Outline of Programming with C**", McGraw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press, 2015.
5. https://www.tutorialspoint.com/cprogramming/index.htm.
6. https://onlinecourses.nptel.ac.in/noc18-cs10/preview.

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18EG C01

ENGLISH

(Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	20 Marks
Credits	2

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 equip the students with basics of writing correct sentences to coherent paragraphs.
3. To equip the students with techniques of writing a précis and an essay by using accurate grammar and appropriate vocabulary.
4. To train the students to describe, define and classify processes and to draft formal reports by adhering to the proper structure.
5. To develop the reading skills and reading comprehension techniques of the students.
6. To develop the students reading, writing, grammatical, lexical and communicative competence

Course Outcomes:

1. The students will understand the nature, process and types of communication and will communicate effectively without barriers.
2. The students will write correct sentences and coherent paragraphs.
3. The students will know how to condense passages by writing précis and write essays by using accurate grammar and appropriate vocabulary.
4. The students will demonstrate advanced writing skills by drafting formal reports.
5. The students will apply their reading techniques and analyze reading comprehension passages.
6. The students will become effective communicators and will display their advanced skills of reading and writing and use correct grammar and appropriate vocabulary in all contexts.

UNIT-I Understanding Communication in English:

Introduction, nature and importance of communication.Process of communication.Basic types of communication - verbal and non-verbal.Barriers to communication.Intrapersonal and interpersonal communication.Johari Window.

Vocabulary &Grammar: The concept of Word Formation. Importance of proper punctuation.Articles.

UNIT-II Developing Writing Skills I:
Types of sentences. Use of phrases and clauses in sentences.Cohesion and coherence. Paragraph writing. Organizing principles of paragraphs in documents.
Vocabulary & Grammar: Cohesive devices. Root words from foreign languages and their use in English. Prepositions.

UNIT-III Developing Writing Skills II:
Techniques for writing precisely. Précis Writing. Essay Writing.
Vocabulary and Grammar: Subject-verb agreement, Noun-pronoun agreement Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.Redundancies, Clichés.

UNIT-IVDeveloping Writing Skills III:
Describing, Defining, Classifying, Providing examples or evidence.Writing introduction and conclusion.
Report writing – Importance, structure and elements of style of formal reports.
Vocabulary and Grammar: Misplaced modifiers. Synonyms, antonyms

UNIT-VDeveloping Reading Skills:
The reading process, purpose, different kinds of texts.Reading comprehension. Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.
Vocabulary and Grammar : Words often Confused. Standard abbreviations.

Text Books:

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

Suggested Readings:

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

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18PY C08

PHYSICS LABORATORY
(for Chemical and Bio-Tech)

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

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. Understand the applications of magnetic and dielectric materials.
4. Know the working of lasers and optical fibres.
5. Distinguish between polarized and unpolarized light.

Experiments

1. Polarimeter – Determination of specific rotation of glucose.
2. Malus's law – Verification of Malus's law.
3. Double refraction – Determination of refractive indices of O-ray and E-ray of given calcite crystal.
4. Single slit diffraction – Determination of wavelength of given monochromatic source.
5. Diffraction Grating – Determination of wavelengths of two yellow lines of mercury light.
6. Double slit diffraction.
7. Fibre optics – Determination of NA and power losses of given optical fibre.
8. Newton's rings – Determination of wavelength of given monochromatic source.
9. Laser – Determination of wavelength of given semiconductor red laser.
10. Dielectric constant – Determination of dielectric constant of given PZT sample.

11. B-H curve – Determination of hysteresis loss of given specimen.
12. Planck's constant – Determination of Planck's Constant using photo cell.
13. M & H values.
14. Error analysis – Estimation of errors in the determination of time period of a torsional pendulum.

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.
4. Indu Prakash, Ram Krishna and A.K. Jha, *A Text Book of Practical Physics*, Kitab Mahal Publications, 2012.

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18CS C02

Programming for Problem Solving
(Programming Lab – I)
(Common to All Programs)

Instruction	4 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives

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

Course Outcomes:

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

1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Identify and rectify the syntax errors and debug program for semantic errors.
4. Analyze the results to evaluate the solutionsof the problems.
5. Solve problems in amodular approach using functions.
6. Implement file operations with simple text data.

Lab experiments

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

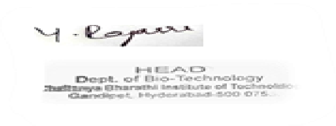
Design the experiments in such a way that the students will be able to end up the solution for a real world problem that uses most of the concepts of C programming language. For example: A banking application where it uses the concepts of operators, control structures, switch case for menu, structures, functions, error handling, files etc.

Suggested Reading:

1. Pradeep Dey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017.
2. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press, 2015.

References:

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



18ME C02

WORKSHOP/ MANUFACTURING PRACTICE

Instruction	1T+4P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	3

Course Objectives:

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

Course Outcomes – (Laboratory): Student will be able to

1. Fabricate components with their own hands.
2. Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. Assembling different components, student will be able to produce small mechanisms/devices of their interest.
4. Gain practical skills of carpentry, tinsmithy, fitting, house wiring.
5. Gain knowledge of different Engineering Materials and Manufacturing Methods.
6. Understand trades and techniques used in Workshop and chooses the best material/ manufacturing process for the application.

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18EG C02

ENGLISH LAB

(Common to all branches)

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 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. The students will enhance their listening skills by practicing IELTS and TOEFL material.
5. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
6. To help students to understand team work, role behavior and to develop their ability to discuss in groups and make oral presentations.

Course Outcomes:

1. The students will differentiate the speech sounds in English.
2. The students will interact with the software and understand the nuances of pronunciation in English.
3. The students will speak with the proper tone, intonation and rhythm and apply stress correctly.
4. The students will demonstrate their listening skills by analyzing the IELTS and TOEFL listening comprehension texts
5. The students will speak with clarity and confidence.
6. The students will work in teams and discuss various topics and demonstrate their presentation skills through posters.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and

description of English phonemic sounds, minimal pairs. The syllable: types of syllables, consonant clusters.

3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – practice with IELTS and TOEFL material
6. **Situational dialogues and role play –** Dialogue writing, **–** Role behavior and role enactment.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
9. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

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

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

B.Tech (Bio-Tech)

SEMESTER – II

S. No	Course Code	Title of the Course	Scheme of Instruction: Hours per week			Scheme of Examination			Credits
			L	T	P/D	Duration of SEE in Hours	Maximum Marks: CIE	Maximum Marks: SEE	
	THEORY								
1	18MT C04/ 18BT C02	Engg. Basics of Biology-II	3	1	-	3	30	70	4
2	18CY C01	Chemistry	3	1	-	3	30	70	4
3	18CE C01	Eng Mec	3	1	-	3	30	70	4
4	18ME C01	Engineering Graphics and	1	-	4	3	30	70	3
5	18EE C01	Basic Electrical Engineering	3	1	-	3	30	70	4
	PRACTICALS								
6	18EE C02	Basic Electrical Engineering Lab	-	-	2	2	15	35	1
7	18CY C02		-	-	3	3	25	50	1.5
		Total	**13**	**04**	**09**	**-**	**190**	**435**	**21.5**

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

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

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18MT C04

ENGINEERING MATHEMATICS– II

(forBiPC Stream of Bio-Tech)

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

Course Objectives:

1. The student is expected to know the behaviour of single valued functions of partial fractions and Rational functions.
2. Master the methods and techniques of integration and definite integrals.
3. Expected to know learn the basics of formation of First Order Differential equations and identifying the Nature of equations.
4. Expected to learn Higher Order Linear Differential Equations and its solutions by various methods.
5. Expected to learn system of Linear Equations and its solutions by various methods.
6. Students enable to learn formation of Differential Equations and modelling of Algebraic Equations and its solutions.

Course Outcomes: On successful completion of this course the students shall be able to

1. To find out Areas, Surface Areas, Volumes can be obtained by definite integrals.
2. Any complicated fraction can be decomposed by using partial fractions, then it makes integrable.
3. Model the First-Order Differential Equations and solve it for various Engineering Branches applications, etc.
4. Model the Higher Order Linear Differential Equations and solve it for various Engineering branches physical problems.
5. To learn how to find out approximate values of Multivariable Algebraic Equations by various methods.
6. It is very useful for Research and Development.

UNIT- I: Partial Fractions: Resolving f(x)/g(x) in to partial fractions, g(x) contains non repeated linear factors, g(x) contains repeated and non repeated linear factors, g(x) contains non repeated irreducible factors, g(x) contains repeated and not repeated irreducible factors.

UNIT - II :Integration: Integration considered as converse of differentiation, simple integrations of algebraic, trigonometric and exponential etc. Methods of integration, integration by parts, integration of rational, irrational and Trigonometric functions, definite integrals

UNIT- III :Differential Equations: Differential equations of First order and first degree, Variable separable, Homogeneous, linear, Bernoulli's equations, Exact differential Equations.

UNIT- IV :Differential Equations of Higher Order: Differential equations of higher order with constant coefficients, Complimentary functions and particular Integrals, Particular Integrals of $e^{ax}, \sin ax , \cos ax , x^{m}, e^{ax} \sin bx , e^{ax} \cos bx$ Differential equations of higher order with variable coefficients-Cauchy linear equations.

UNIT- V :Linear Algebra: Solution of system of Linear equations by Inverse, Gauss Jordan methods and Cramer's Rule. Cayley Hamilton Theorem (without proof)

Text Books:

1. Shanti Narayan and P.K. Mittal," Differential Calculus", 30th edition, S.Chand publishers, 2005.
2. A.R.Vasistha , "Matrices", 43rd edition, Krishna Prakashan Media (P) Ltd. 2014.
3. B.S.Grewal, "Higher Engineering Mathematics", 43rd edition, Khanna Publishers, 2014.

Suggested Reading:

1. William E.Boyce /Richard C.Dip, "Elementary differential equations", 9th Edition, wiley publishers, 2008.
2. N P Bali, "A Text Book of Engineering Mathematics", 9th Edition, laxmi publishers, 2016.
3. Joseph Edwards, "Differential Calculus For Beginners", arihant publishers, 2016.
4. KantiB.Datta, "Mathematical Methods of Science and Engineering",CENGAGE Learning publishers, 2014.

18BT C02

BASICS OF BIOLOGY-II

(for MPC Stream of Bio-Tech)

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

Course Objectives:

1. This course aims at providing knowledge on basic concepts of Biology to mathematic background students.
2. The course is designed to give understanding salient features of animal kingdom classification.
3. This course aims at providing an insight into animal tissues and their types.
4. To provide knowledge on various parasites, lifecycle and diseases caused by them.
5. The course aims at imparting theoretical knowledge on various biotic interactions in nature.

Course Outcomes: By the end of the course students be able to

1. Explain the criteria for classification of various organisms in animal kingdom.
2. Identify the basic structure and function of various organelles of animal cell.
3. Discuss the organization symmetry and tissue types in animal system.
4. Outline various biotic interactions in nature.
5. Demonstrate the basic information on gene, alleles and its inheritance.
6. Compare the gene regulation system in prokaryotes and eukaryotes.

UNIT- I

ANIMAL KINGDOM CLASSIFICATION

Classification of animal kingdom. Phylogeny of invertebrate and vertebrate phyla. Salient features of nonchordates up to phyla, and chordates up to class level. Binomial and trinomial nomenclature. Concept of species and genus.

UNIT- II

CELL AND TISSUES: STRUCTURE AND FUNCTIONS

Structure of animal cell and its organelles. Differences between plant and animal cell. Level of organization, multicellularity, diploblastic and triploblastic conditions. Asymmetry, symmetry: radial symmetry and bilateral symmetry. Acoelomates, pseudocoelomates and eucoelomates in brief. Animal tissues structure and functions. Different types of animal tissues and their functions. Epithelial, Connective, Muscular and Nervous tissues in brief

UNIT- III

PARASITOLOGY: PARASITISM AND PARASITIC ADAPTATION

Health and disease: introduction, life cycle, pathogenecity, treatment and prevention; *Entamoeba histolytica*, *Plasmodium vivax, Ascaris lumbricoides* and *Wuchereria bancrofti*. Brief account of pathogencity, treatment and prevention of typhoid, pneumonia, common cold and ring worm.

UNIT - IV

ECOLOGY AND ENVIRONMENT

Organism and environment, habitat and niche. Population and ecological adaptations, population interactions. Abiotic environmental factors – light, temperature, water and radiation. Biotic environmental factors –neutralism, competition, mutualism, commensalism, parasitism, predation. Attributes, growth, birth rate and death rate, age distributions.

UNIT – V

GENETICS

Structure and Functions of chromosome. Concept of gene and alleles, multiple alleles, ABO blood groups. Sex chromosomes, Sex determination, Sex linked inheritance, gene expression and regulation in prokaryotes and eukaryotes.

Text Books:

1. Biology. Raven, Johnson, Losos, Mason, Singer. Tata Mc Graw Hill Publishing Co. Pvt. Ltd 9th edition, 2010.
2. Beginning Science: Biology. B.S. Beckett. Oxford University Press.1st edition, 1983.

Suggested Reading

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. & J.I., Spicer (2002) The Invertebrates: A New Synthesis.III Edition, Blackwell Science.
2. K Vaidhyanath, K Pratap Reddy and K Sathya Prasad, Introduction to Applied biology and Biotechnology. BS Publications, India, 2004.

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18CY C01

CHEMISTRY

(Common to all branches)

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

Course Objectives

1. 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.
2. This syllabus helps at providing the necessary introduction of the inorganic chemistry principles and concepts of chemical bonding involved in a comprehensive manner understandable to the students aspiring to become practicing engineers.
3. Thermodynamic and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
5. New materials lead to discovering of technologies in strategic areas like defense and space research for which an insight into nano and composite materials of modern chemistry is essential.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations & Ionic Equilibria.
3. List major chemical reactions that are used in the synthesis of molecules.
4. Apply the various methods used in treatment of water for domestic and industrial use.

5. Discuss the various Engineering materials & Drug synthesis & their applications.

UNIT- I Atomic and molecular structure:

Molecular Orbital theory - atomic and molecular orbitals.Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Energy level diagrams of diatomics (H_2, He_2^+,N_2, O_2, O_2^- , CO, NO). Pi- molecular orbitals of butadiene, benzene and their aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

UNIT-II Use of free energy in chemical equilibria and Ionic Equilibria:

Use of free energy in chemical equilibria : Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials –electrochemical series.Nernst equation and its applications. Potentiometric Acid base & Redox Titrations.Numericals.

Ionic Equilibria: Solubility product, Determination of solubility product, Applications of solubility product- Determination of solubilities of sparingly soluble salts; Predicting precipitation reactions; Precipitation of an insoluble salt; Precipitation of soluble salts ; Inorganic analysis .Numericals.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures , Symmetry and chirality, Stereoisomers - Configurational isomers (Geometrical&Optical isomers), Conformational isomers - Newman and sawhorse representations of n-butane, enantiomers (lactic acid), diastereomers (Tartaric acid), optical activity, absolute configurations, Sequence rules for R&S notation.

Organic reactions

Types of Organic reactions:

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

Addition Reactions:

Electrophilic Addition – Markonikoff’s rule

Nucleophilic Addition – (Addition of HCN to carbonyl compounds)

Free radical Addition - Anti Markonikoff’s rule (Peroxide effect)

Eliminations-E_1 and E_2 (dehydrohalogenation of alkyl halides)

Oxidation with $KMno_4$, $K_2 Cr_2O_7$; **Reduction** with $LiAlH_4$,$NaBH_4$
Cyclization (Diels - Alder reaction)

UNIT–IV 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 , Ozonisation & UV radiation.

UNIT-V Engineering Materials and Drugs:
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.
Conducting polymers- Definition, classification and applications.
Drugs-Introduction,Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

TEXT BOOKS

1. P.C. Jain and M. Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Mali, G.D.Tuli and R.D.Madan, “Selected topics in Inorganic Chemistry”, S Chand & Company Ltd, New Delhi,reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, “Organic Chemistry”, Pearson, Delhi, 7thedition(2011).
4. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C. Sudhakar, “Drugs”, Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READINGS

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

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18CE C01 **ENGINEERING MECHANICS**

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

Course Objectives:

1. The objective of this course is to understand the resolution of forces and to obtain resultant of all force systems, to understand moment of a force and equilibrium conditions of static loads for smooth and frictional surface
2. To obtain centroid, centre of gravity and moment of inertia for various regular and composite areas and bodies.
3. To understand the basic structural analysis, principles of virtual work and energy methods.
4. To know the basic concepts of dynamics and analysis as a particle and rigid bodies.
5. To understand the work energy principles, impulse momentum and their applications and to know the concept of simple harmonic motion and free vibration.

Course Outcomes: The students will be able to

1. Solve problems dealing with forces in plane and space force systems, draw free body diagrams to analyze various problems in equilibrium, for smooth and frictional surface.
2. Determine centroid and moment of inertia for elementary, composite areas and bodies.
3. Analyze simple trusses for forces in various members of a truss.
4. Solve problem in kinematics and kinetics of particles and rigid bodies.
5. Analyze body motion using work energy principles, impulse and momentum approach and able to apply the concepts of simple harmonic motion and free vibrations in dynamics.

Unit–I: Resolution, Resultant and Equilibrium of force system and Friction:
Concepts of force, System of forces, components of forces in a plane and in space systems.Resultant of force systems.Moment of forces and its applications.Couples and its applications.Equilibrium of Force systems. Free body diagrams, equation of equilibrium of coplanar and spatial force systems. Static indeterminacy. Types of friction, Laws of friction, application of friction to a single body & connecting systems, wedge friction.

Unit–II: Centroid ,centre of gravity and moment of Inertia:
Centroid of simple figures from first principle, centroid of composite sections. Centre of gravity and its implications, Definition of Area moment of Inertia, Moment of inertia of plane section from first principles, Theorems of moment of inertia, moment of inertia of standard sections and composite sections, Mass moment of inertia of rectangular and circular plates, cylinder, cone & sphere.

Unit–III: Analysis of simple trusses, Virtual work and Energy methods:
Analysis of simple trusses using method of joints, methods of sections. Determine if a member is in tension or compression, zero force members. Virtual displacements, Principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom.Conservative forces and potential energy, energy equation for equilibrium.

Unit–IV: Particle Dynamics:
Rectilinear and curvilinear translation using rectangular, normal and tangential components.Relative and constrained motion. Newton's 2nd Law, rectangular and path coordinates. Basic terms, general principles in dynamics, D'Alembert's principle and its application in plane motion and connected bodies.Instantaneous centre of rotation in plane motion and simple problems.

Unit–V: Work- Energy, Impulse-momentum and Mechanical Vibrations:
Equation of work energy for translation and fixed axis rotation, work energy principles applied to particle motion, connected systems. Introduction to linear impulse momentum, principle of conservation of linear momentum, Impact, direct and oblique. Introduction to vibration, free and forced vibrations, simple harmonic motion, simple pendulum and compound pendulum.

Text Books:

1. Reddy Vijaykumar K. and J. Suresh Kumar," Singer's Engineering Mechanics Statics and Dynamics", B. S. Publications 2011.
2. A. Nelson, "Engineering Mechanics", Tata McGraw Hill, New Delhi, 2010.

Suggested Reading:

1. Irving H. Shames, "Engineering Mechanics", 4th Edition, Prentice Hall, 2006.
2. F. P. Beer and E. R .Johnson, "Vector Mechanics for engineers, Vol. I - Statics, Vol. II - Dynamics",
   9th edition, Tata McGraw Hill, 2011.
   R. C. Hibbeler, "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press, 2006.

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18ME C01

ENGINEERING GRAPHICS AND DESIGN

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

Course Objectives:

1. to prepare to design a system, component, or process to meet desired needs within realistic constraints.
2. to prepare the student to communicate effectively.
3. to prepare the student to use the techniques, skills, and modern. engineering tools necessary for engineering practice.
4. to get exposure to a CAD package.

Course Outcomes:

1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design.
3. To become familiar with engineering graphics standards.
4. Exposure to solid modelling.
5. Exposure to computer-aided geometric design.
6. Exposure to creating working drawings.
7. Exposure to engineering communication.

Detailed contents

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Coordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling; Introduction to Building Information Modeling (BIM).

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

UNIT-1 Introduction to Engineering Drawing:

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute;

UNIT-2 Orthographic Projections:

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes (without traces) ; Projections of planes inclined Planes;

Introduction to CAD package:

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

UNIT-3 Projections of Regular Solids:

Projection of Prism, Cylinder, Pyramid and Cone : Simple position, axis inclined to one of the reference plane only. Customization & CAD Drawing: consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT-4 Sections and Sectional Views of Right Angular Solids:

Sections of solids in simple position Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.

Annotations, layering & other functions:

applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques;

Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and twodimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

UNIT-5 Isometric Projections:
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Viceversa, Conventions;
Demonstration of a simple team design project:
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and ssembly levels; (Examples of specific components to the branch of study may be included)

Text Books:
1. N.D.Bhatt, Elementary Engineering Drawing, Charotar Publishers, 2012.
2. K.L.Narayana and P.K.Kannaiah, – Text Book of Engineering Drawing + Scitech Publications, 2011.
3. Basanth Agrawal and C M Agrawal –Engineering Drawing 2e –, McGraw-Hill Education(India) Pvt.Ltd.

Suggested Reading:
1. Shaw M.B and Rana B.C., –Engineering drawing V+d H Pearson, 2nd edition, 2009.
2. K.Veenugopal, –Engineering Drawing and Graphics + Autocad V+d H New Age International Pvt.Ltd, 2011.
3. Bhattacharya. B, –Engineering Graphics I. K. International Pvt.Ltd, 2009.

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18EE C01

BASIC ELECTRICAL ENGINEERING

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

Course Objectives:

1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.,
3. To understand the basic principle of operation of Transformer and DC machines.
4. To understand the basic principle of operation of DC machines and AC machines.
5. To know about different types of electrical wires and cables, domestic and industrial wiring.
6. To understand safety rules and methods of earthing.

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

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

UNIT-I: DC Circuits

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

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

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

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

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

Text books:

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

Suggested Reading:

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

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18EE C02

BASIC ELECTRICAL ENGINEERING LAB

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

Course Objectives:

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

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

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer.
6. Understand the basic characteristics of dc and ac machines.

List of Laboratory Experiments/Demonstrations:

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

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18CY C02

CHEMISTRY LAB

(Common to all branches)

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

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. The student should be conversant with the principles of volumetric analysis and identification of organic functional groups.
3. To apply various instrumental methods to analyze the chemical compounds and to improve understanding of theoretical concepts.

Course Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

Thestudents will learn to:

1. Estimate rate constants of reactions from concentration of reactants/ products as afunction of time.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Synthesize a small drug molecule and Identify the organic compounds.
4. understand importance of analytical instrumentation for different chemical analysis.
5. Perform interdisciplinary research such that the findings benefit the common man.

Chemistry Lab

1. Estimation of temporary and permanent hardness of water using EDTA solution.
2. Estimation of amount of chloride in water.
3. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order).
4. Estimation of amount of HCl Conductometerically using NaOH solution.
5. Estimation of (a) amount of CH_3 COOH Conductometerically using NaOH [illegible] d CH_3 COOH present in the given mixture [illegible] using NaOH solution.

6. Estimation of amount of HCl Potentiometrically using NaOH solution.
7. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution.
8. Distribution of acetic acid between n-butanol and water.
9. Synthesis of drug - Aspirin.
10. Organic Chemistry- Identification of Functional groups - neutral group (carbonyl groups-acetaldehyde and acetone); acidic group (benzoic acid); basic group (aniline).
11. Determination of surface tension of organic solvents (ethanol, ethyl acetate)
12. Determination of Viscosity.

TEXT BOOKS

1. J. Mendham and Thomas ," Vogel' s text book of quantitative chemical analysis", Pearson Education Pvt.Ltd. New Delhi ,6th ed. 2002.

SUGGESTED READINGS

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

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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:Bio-Technology

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
Choice Based Credit System
B.Tech (Bio-Technology)

SEMESTER – III

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16MT C06	Mathematics –III	3	-	3	30	70	3
2	16BT C05	Process Principles and Reaction Engineering	4	-	3	30	70	4
3	16BT C06	Biochemistry	4	-	3	30	70	4
4	16BT C07	Cell Biology	3	-	3	30	70	3
5	16BT C08	Microbiology	3	-	3	30	70	3
6	16BT C09	Genetics	3	-	3	30	70	3
PRACTICALS								
7	16BT C10	Biochemistry Lab	-	3	3	25	50	2
8	16BT C11	Microbiology Lab	-	3	3	25	50	2
9	16EG C03	Soft Skills and Employability Enhancement Lab	-	2	2	15	35	1
TOTAL			**20**	**8**	-	**245**	**555**	**25**

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 internal assessment (Sessional) 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
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 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.

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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%.

16MT C06

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: To learn

1. Identifying limit of functions which are in Indeterminate Forms.
2. Understand the basic concept of continuity, differentiability and geometric interpretation of mean value theorems.
3. Concept of partial differentiation, maximum and minimum.
4. Identifying vector, scalar addition, multiplication, geometrical interpretation in 2D, 3D space.
5. Understand the concept of scalar and vector point functions of divergence and curl of vector functions and its physical interpretations.

Outcomes: On the successful completion of the course, the student shall be able to

1. Solve the limit problems by using L-Hospital rule.
2. Solve the problems based on Mean value theorems.
3. Solve maxima and minima problems.
4. Solve vector and scalar triple product related problems.
5. Solve divergence and curl related problems.

UNIT-I

Indeterminate Forms: Types of Indeterminate forms L-Hospital's rule to evaluation of limits in indeterminate forms $\frac{0}{0};\frac{\infty}{\infty};\infty-\infty;1^{\infty};\infty^{0};0^{0};0\times\infty$, Maclaurin's series and Taylor's series (without proof) for single variable.

UNIT-II

Mean value theorems: Fundamental theorem, Continuity and differentiability- Rolle's Theorem, Lagrange's theorem, Cauchy's theorem, Geometrical interpretations-related problems (statements only).

UNIT-III

partial differentiation-Homogeneous functions-Euler's theorem on homogeneous functions, Taylor's series of two variable, maxima and minima of functions one variable.

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UNIT-IV

Vector Algebra : Addition of vectors, scalar multiplication, angle between two non zero vectors, linear combination of vectors, component of vectors in three dimensions, scalar product-geometrical interpretations- orthogonal projections, properties of dot product, angle between two vectors, vector product of two vectors and properties, scalar triple product, vectors triple products-results.

UNIT-V

Vector differentiation: Definitions- scalar and vector point functions, vector differential operator, Gradient, Divergence and Curl, Solenoidal and Irrational vectors, properties of gradient, divergence and curl (vector identities).

Text Books:

1. B.S.Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2015.
2. N P Bali and Manish Goyal, "A Text Book of Engineering Mathematics", 9th Edition, Laxmi publishers, 2016.
3. Narayan Shanti and Mittal P.K. ," Differential Calculus" , 30th edition, S Chand publishers, 2005.

Suggested Reading:

1. A.R.Vasistha, "Matrices" , 43rd edition, Krishna Prakashan Media (P) Ltd. 2014.
2. A.R.K Jain and S.R.K Iyenger, "Advance engineering mathematics",3rd edition, Narosa publications, 2007.
3. Joseph Edwards, "Differential Calculus For Beginners", arihant publishers, 2016.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th edition, Wiley publishers, 2015.

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16BT C05

PROCESS PRINCIPLES AND REACTION 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:

1. The aim of the course is to impart knowledge of the basic chemical engineering principles and techniques used in analyzing a chemical process.
2. This course also aims to enable the students to evaluate material and energy balances in different units.
3. Through this course the students are given an understanding of application of principles of unit operations and unit processes in biotech Industries.
4. This course aims at analyzing the kinetics of chemical reactions.
5. The aim of the course is also to give the students an understanding of the theory of biochemical reactors and enhanced skill in formulation and analysis of different types of reactors used in biochemical engineering.
6. The aim of the course is to impart knowledge of the animal and plant cell reactor technology.

Course Outcomes:

1. At the end of the course student should be able to solve the problems encountered in the preparation of material and energy balances of the process.
2. Be able to determine the flue gas composition from fuel composition and vice versa.
3. Be able to develop generalized flow sheets for different chemical processes.
4. Be able to write rate equations for any given chemical reaction.
5. Be able to perform basic design calculations of various reactors.
6. Be able to identify the reasons for non ideality.

UNIT 1:

DIMENSIONS AND SYSTEM OF UNITS

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Fundamental quantities, derived quantities and conversions; SI and MKS system of Units; Basic Chemical Engineering calculations-Atomic, Molecular and Equivalent weights, molar concept, Concentration units for pure components, Vapor pressures, Moles, Mixers and solutions, Molarity, Molality, Normality and Partial pressures; Laws of Chemical Combination; Definition of Stochiometry; Composition of mixers and solutions; Weight fraction; Mole fraction; Volumetric composition; Density and Specific gravity, Ideal gas law; Ideal mixtures and solution; Dalton's law of additive pressures; Amagots law of additive volumes.

UNIT II:

UNIT OPERATIONS IN BIOPROCESSES

Application of principles of unit operations and unit processes in biotech Industries, Application of principles of transport phenomenon (momentum, mass and heat transfer) in bioprocessing. Outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, generalized process flow sheets. Laws of conservation of mass, meaning of material balance and its applications, Process flow sheet, Drawing material balance on non reacting steady system, Conversion, yield, Limiting reactants, Excess reactants, Recycling, By-passing, Material balances on steady state reacting systems with recycling and By-passing.

UNIT III:

MATERIAL BALANCES

Law of conservation of ene gy, Meaning of energy balance and its importance, Inputs of energy balance, Specific heat and sensible heat, Latent heat and heats of transition, Sublimation, Enthalpy of solutions, Standard heats of formation, Standard heats of combustion, Standard heats of reaction, Bess's law, Kirchoffs law, Determination of heat of reaction at temperature other than standard temperature using specific heat relationships, Combustion calculations, Combustion air requirements, determination of flue gas composition from fuel composition and vice versa.

UNIT IV:

INTRODUCTION TO REACTION KINETICS

Concepts of Reaction Kinetics, Types of reaction, order of reaction, The effect of temperature and pH on reaction rate. Rate equations and Reaction mechanisms; Interpretation of batch reactor data, constant volume batch reactor, integral method of analysis of data for reversible and irreversible reactions. Searching for mechanism - Arrhenius equation - Growth Kinetics: Batch growth quantifying cell concentration, chemostat growth,

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UNIT V:

INTRODUCTION TO BIOREACTION ENGINEERING

ors; Classification of bioreactors; Reactor configurations; Description of a conventional bioreactor with all aspects; Design and construction criteria of a bioreactor; Residence time distributions, concentration, and temperature distributions; Models of non-ideal reactors.

Animal and plant cell reactor technology- Environmental requirements for animal cell cultivation, reactors for large-scale production using animal cells, plant cell cultivation.

Text Books:

1. Hougen and Watson K M and Ragatz R A, "Chemical Process Principles", 2nd Edition, Wiley, 1959.
2. Bhatt B I and S M Vora, "Stoichiometry", 4th Edition, Tata McGraw Hill 2006.
3. Chemical Reaction Engineering, Octave Leven Spiel.

Suggested Reading:

1. David M. Himmelblau, James B. Riggs, "Basic Principles and Calculations in Chemical Engineering", 8th Edition, Prentice Hall, 2012.
2. Dr.AVN.Swamy, "Fundamentals of Biochemical Engineering", BS Publications, 2007.
3. Warren Lee McCabe, Julian Smith, Peter Harriott, "Unit operations of chemical engineering", Mc-Graw Hill, 7th Edition 2005.
4. Pauline M. Doran, "Bio-process Engineering Principles", 2nd Edition, Academic press, 2013.

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16BT C06

BIOCHEMISTRY

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. Students will learn structure, functions and metabolism of different biomolecules.

Course outcomes:

1. Recognize different biomolecules structures.
2. Describe the functions of various biomolecules.
3. Evaluate the energy yield from the catabolism of carbohydrates and lipids.
4. Reconstruct the anabolism of carbohydrates and lipids.
5. Outline steps involved in catabolism and anabolism of proteins.
6. Summarize steps involved in catabolism and anabolism of nucleic acids.

UNIT I:
BIOMOLECULES

Carbohydrates- classification, monosaccharide, disaccharides, polysaccharides, Glycoproteins; glycolipid; Classification and nomenclature of lipids; Amino acid - Classification and its structure, peptide bond- structure; protein structure - primary, secondary, tertiary and quaternary structure; Structure of nucleotides, nucleosides and nitrogenous bases; chemical structure of DNA and RNA;

UNIT II:
METABOLISM OF CARBOHYDRATES

Carbohydrate Metabolism- Glycolysis, HMP shunt, Citric Acid Cycle and Oxidative Phosphorylation, Metabolic Pathways- Biosynthesis of Glucose; Glycogen metabolism.

UNIT III:
METABOLISM OF LIPIDS

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Lipid Metabolism - Catabolism of Fatty Acids, Triglycerol and Cholesterol Metabolism; Metabolic Pathways- Biosynthesis of Saturated and Unsaturated Fatty Acids, Triglycerol, Phospholipids and Sphingolipids.

UNIT IV:

METABOLISM OF PROTEINS

Amino acids metabolism- Biosynthesis of aromatic amino acids, Peptides; Metabolic fate of Amino group; Nitrogen Excretion and Urea Cycle; Catabolism of aromatic and branched chain amino acids; Transamination, Oxidative Deamination and Oxidative Decarboxylation.

UNIT V:

METABOLISM NUCLEIC ACIDS

Nucleic Acid Metabolism- Biosynthesis of Purine and Pyrimidine, Ribonucleotides, synthesis of Deoxyribonucleiotides; Degradation of Purine and Pyrimidine Nucleotides.

Texts Books:

1. Eric E.Conn, Paul K Stumpf, George Bruening, Roy H Doi, "Outlines of Biochemistry", 5//E, John Wiely and Sons, 2006.
2. David Lee Nelson and Michael M. Cox, Lehninger "Principles of Biochemistry", 6th edition, W. H. Freeman, 2013.

Suggested Reading:

1. Donald Voet and Judith G. Voet, "Biochemistry", 4th edition, John Wiley & Sons, New York, 2011.
2. Reginald Garrett and Charles Grisham, "Biochemistry", 5th edition, Cengage Learning, 2012.
3. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, "Biochemistry", 6th Edition. W. H. Freeman and Company, 2010.
4. Robert Murray, David Bender, Kathleen M. Botham, Peter J. Kennelly, Victor Rodwell, P. Anthony Well, "Harpers illustrated Biochemistry", 29th edition, McGraw Hill Professional, 2012.

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16BT C07

CELL BIOLOGY

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

Course Objectives

1. Student is made to understand the basics of cell biology i.e. concept of cellular organelles and their functions.
2. Students are taught the structure of cytoskeleton, and how it maintains the cell structure integrity.
3. Student made to understand the structure of plasma membrane, and how it regulates the fluid balance.
4. Students are made aware of cell division and regulation of cell cycle.
5. Students are enlightened about cell signaling over being basis of cancer.
6. The concept of protein targeting is introduced to the students.

Course Outcomes:

1. Students able to understand the structure & functions of cell organelles.
2. Students enlightened about the transport of metabolites.
3. Explain the regulation of cell cycle and its control.
4. Analyze the importance of growth factors/ Receptors and their role in causing cancer.
5. Recognize the mechanisms in transport of proteins to destination.
6. Explain the advances in cell biology, protein degradation.

UNIT I: CELL STRUCTURE, ORGANELLES AND THEIR FUNCTIONS

Cell structure and organization in bacteria, plants and animal cells; structure and functions of cell wall, lysosomes, ribosomes, golgi complex, peroxisomes, glyoxysomes, mitochondria, plastids, endoplasmic reticulum, vacuoles, centrioles; cytoskeleton - composition, structure and functions of microtubules, microfilaments and intermediate filaments; nucleus, its ultra structure, (nuclear envelope, nucleoplasm, chromatin fibers).

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UNIT II: MEMBRANE TRANSPORT

Biomembrane - lipid composition and structural organization, protein components and basic function, transport across membrane - passive diffusion, facilitated diffusion, osmosis, active transport (Na+/K+ Pump), cotransport; uniport, antiport, symport.

UNIT III:CELL DIVISION AND CELL CYCLE

Cell Division: mitosis and meiosis- events and significance; meiosis and reproductive cycle.
Cell cycle: Different phases of cell cycle; check points of cell cycle; Regulation of cell cycle - cyclins and cyclin dependent kinases;

UNIT IV:CELL COMMUNICATION

Basic concepts of cell communication; bacterial cell communication - Quorum sensing; multicellular organisms- intercellular communication through channels (gap junctions and plasmodesmata, cell-cell junctions), chemical signals (autocrine, paracrine, hormonal); cell signaling-signal transduction pathway; signal receptor proteins- G protein linked receptors(Jak/stat kinases), tyrosine kinase receptors, secondary messengers (cAMP) signaling path ways in cancer (hedgehog signaling, frizzled signaling).

UNIT V:PROTEIN TARGETING/CELL DEATH

Targeting signals, targeting cytosolic proteins to mitochondria, chloroplast, nucleus; co-translational transport into RER, vesicle formation and transport, role of chaperones, applications of protein targeting, apoptosis, necrosis, senescence, proteasome degradation, mitochondrial degradation, Proteiostasis.

Text Books:

1. Geoffrey M. Cooper and Robert E. Hausman, "The cell: A molecular approach", 6th edition, Sinauer Associates, 2013.
2. Gerald Karp, "Cell and Molecular Biology": concepts and experiments, 6th edition, John Wiley & sons, 2009.
3. Benjamin Lewin, Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick, "Lewin's Genes XI", Jones and Bartlett publishers,2014

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Suggested Reading:

1. Bruce Alberts, Dennis Bray, Karen Hopkin, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, "Essential Cell Biology", 4^{th} edition, Garland Science, 2013.
2. Rastogi S.C, "Cell Biology", 3^{rd} edition, New Age International, 2005.
3. Powar, C.B, "Cell Biology", Himalya Publishing house, 2006.

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16BTC08

MICROBIOLOGY

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

Course Objectives: Students are made to understand the following concepts during there course of time:

1. History and scope of microbiology.
2. Classification of different group of microorganisms.
3. Concepts of sterilization and preparation of culture media for growth of microorganisms.
4. Various methods of preservation of microorganisms and their importance.
5. Preparation of culture media for growth of microorganisms.
6. Assimilation of nutrients by microorganisms and importance of bacterial growth phases.
7. Microbial pathogens like V. cholera, HIV, rabies virus causing diseases in humans and multidrug resistance of pathogens like M. tuberculosis and Hepatitis B virus.

Course Outcomes:

1. Explain contributions made by different scientists in microbiology.
2. Identify General characteristics of microorganisms and types of Taxonomy.
3. Select Physical and chemical methods of sterilization.
4. Demonstrate the preparation and functions of different types of media.
5. List classification of nutrients and types of assimilation methods in micro organisms.
6. Outline the Life cycle of pathogens causing diseases in humans.

UNIT I:

HISTORYAND INTRODUCTION TO MICROBIOLOGY

History and scope of microbiology, contributions of Antony van Leuwenhoek Louis Pasteur, Robert Koch, Iwanowskii, Edward Jenner; prokaryotic cell structure - plasma membranes, cytoplasmic matrix - inclusion bodies, ribosome, bacterial chromosome and plasmids, cell wall, components external to cell wall - capsule, slime layer, pili, fimbriae, flagella, bacterial endospores and their formation. Importance of fixation and stains.

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UNIT II:

CLASSIFICATION OF MICROORGANISMS

General and colony characters of major groups of microorganisms - algae, fungi, protozoa, bacteria and virus; identification of microorganisms by major taxonomical characteristics (morphological, physiological, ecological, cultural, metabolic/biochemical, immunological and genetic). classification of microorganisms - concept of classification; taxonomic groups; Haeckel's three kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woes.

UNIT III:

MICROBIOLOGICAL TECHNIQUES

Methods of culturing of microorganisms in lab and industry - culture media, (liquid, semi-solid and solid media, synthetic media and complex media), isolation of pure cultures (streak, spread and pour plate methods). Serial dilution. concept of sterilization - methods and their application- physical methods (heat, filtration and radiation), chemical methods (phenolics, alcohols, halogens, heavy metals, dyes, quaternary ammonium compounds, aldehydes, gaseous agents), methods of preservation of microorganisms and their importance (Bacterial cultures).Biosafety cabinet.

UNIT IV:

MICROBIAL PHYSIOLOGY AND GROWTH

Nutrition in microorganisms and assimilation of major nutrients: active and passive transport. Facilitated diffusion and group translocation. Microbial growth - growth curve, mathematical expression of growth, measurement of microbial growth (cell numbers and cell mass), importance of growth phases of microorganisms; balanced and unbalanced growth, synchronous growth, factors affecting bacterial growth (solutes, water activity, pH, temperature, oxygen concentration, osmotic pressure, radiation).

UNIT V:

MEDICAL MICROBIOLOGY

Virulence factors ; air borne diseases (Tuberculosis), water borne diseases (Vibrio cholera, Hepatitis), zoonotic infections(rabies), extracellular pathogens , staphylococcus, streptococcus; facultative intracellular pathogen -obligate intracellular pathogen - rickettsia, chlamydias; sexually transmitted disease - syphilis; viral diseases - influenza, measles and HIV., Multidrug resistance (Mycobacterium tuberculosis, hepatitis B virus).

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Text Books:

1. Pelczar Michael J., Krieg Noel R., Chan, E.C., "Microbiology", 5^{th} edition, McGraw Hill higher education1993.
2. Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A-Stahl and Clark, "Brock Biology of Microorganisms", 13^{th} edition, Prentice Hall International Inc, 2010.
3. R.Ananth Narayan, "Text Book of Microbiology", 7^{th} edition, Universities Press, 2009.

Suggested Reading:

1. Powar C.B. and Daginawala H.F., "General Microbiology - Vol I & II", 2^{nd} edition, Himalaya publishing house, 2005.
2. Arti Kapil, Ananthanarayan and Paniker's "Text book of Microbiology", 9^{th} edition, Orient Blackswan, 2013.
3. Roger Y Stanier, "General Microbiology", 5^{th} edition, Palgrave Macmillan Limited, 1999.

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16BT C09

GENETICS

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. Student is made to understand the basics of genetics, ie. Concept of how genes are responsible for inheritance of characteristics.
2. Students are taught the structure of chromosome, and how it stores genetic information.
3. Importance of chromosome taught by showing the effects of mutations on chromosomes.
4. Students are enlightened about crossing over being the basis of genetic diversity.
5. Students are made aware of chromosome related genetic disorders.
6. The concept of extra chromosomal inheritance is introduced to the students.

Course Outcomes:

1. Apply to real life situations, the principles of human heredity.
2. Incorporate the fundamentals of gene in order to understand how they impact humans.
3. Be able to describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis.
4. Be able to describe the main modes of Mendelian and non-Mendelian inheritance.
5. Be aware of the role of both genetic and environmental factors in multifactorial Conditions such as, cancer, diabetes and psychiatric disorders.
6. Be able to take a family history and construct and interpret a pedigree.

UNIT I:

PHYSICAL BASIS OF HEREDITY

Mendel's laws of inheritance - segregation, independent assortment, modification of mendelian principles: co-dominance, incomplete dominance, multiple alleles, gene interactions, epistatic interactions, pleotropism. Interaction of genotype and environment: penetrance, expressivity, phenocopy.

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UNIT II:

CHROMOSOME STRUCTURE AND ABBERATIONS

Eukaryotic chromosome structure, function, karyotyping; specialized chromosomes: gaint chromosomes - polytene and lamp brush chromosomes; chromosomal aberrations- structural aberrations (deletions, duplication, inversion and translocation), numerical aberrations (aneuploidy, euploidy, auto polyploidy and allopolyploidy). Mutations - spontaneous, induced; physical and chemical mutagens; lethal mutation (characteristics and types), AMES test, applications of mutations.

UNIT III:

LINKAGE AND CROSSING OVER

Concept of linkage and crossing over, cytological basis of crossing over (in Drosophila and Maize), factors affecting recombination frequency, linkage maps; mechanism of recombination - model involving single strand breaks and double strand break in DNA duplex, significance of Crossing over. Two point and three point test cross. Interference. Tetrad analysis.

UNIT IV:

SEX DETERMINATION, SEX LINKED AND GENETIC DISORDERS

Sex chromosomes, sex determination, mechanism of sex determination in animals (insects and humans) and plants, sex determination by genic balance and Y-linked genes. Dosage compensation, Maryleon's hypothesis; sex linkage, non disjunction of x chromosomes, sex linked disorders and autosomal disorders in human beings. Garrod's inborn errors of metabolism, one gene one enzyme hypothesis, one gene one polypeptide hypothesis.

UNIT V:

EXTRA CHROMOSOMAL INHERITANCE AND QUANTITATVE GENETICS

Extra chromosomal inheritance - inheritance of mitochondrial and chloroplast genes, maternal inheritance(CMS, nuclear petites in yeast, Mirabilus jalapa. Transgressive segregation, quantitative characters, Gene frequency, gene pool, Hardy- Weinberg Law, equilibrium, Fitness and selection Goodness of fit : Chi-square-test.

Text Books:

1. Singh, B.D. "Genetics - 3rd edition", Kalyani Publications , 2004.
2. Snustad, D.Peter, Simmons Michael, "Principle of Genetics 6th edition", Wiley publication, 2011.
3. Gardner, E. J., Simmons, M. J., Snustad, D. P. and Snustad, "Principles of Genetics", John Wiley and Sons, Inc. 1985.

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Suggested Reading:

1. Verma, P. S. and V. K. Agrawal.. "Cell Biology, Genetics, Molecular Biology, Evolution and Ecology". S. Chand & Company Ltd., New Delhi, 2004.
2. Cummings Michael R, Charlotte A. Spencer, Michael A. Palladino Concepts of Genetics . Pearson Education. ISBN 0321754352, 9780321754356, 2012.
3. Krebs JE., Goldstein E.S and Kilpatrick S.T., "Lewin's Genes XI", Jones Bartlett publishers, 2014.
4. Gupta PK, "Genetics", 4th Rev Edition (2nd Reprint) Rastogi Publications, 2011.
5. Hartl L, Daniel and Ruvolo MGenetics, "analysis of genes and genomes", Eight edition, Jonnes and Bartlett Learning Books. USA, 2012.

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16BT C10

BIOCHEMISTRY 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. Students will learn the laboratory safety and standard operating procedures.
2. Students will learn how to estimate and analyze different biomolecules.

Course outcomes:

1. Learn and apply the laboratory safety and standard operating procedures.
2. Prepare the solutions and biological buffers.
3. Estimate and analyze carbohydrate by different methods.
4. Estimate and analyze amino acids and proteins by different methods.
5. Estimate and analyze lipids and compare the acid value, saponification value and iodine valve of various lipids.
6. Estimate and analyze nucleic acids.

List of Experiments:

1. Introduction to Biochemistry Lab: Units, Volume / Weight measurements, concentration units.
2. Preparation of Solutions - percentage solutions, molar solutions, normal solutions and dilution of stock solution.
3. Measurement of pH.
4. Preparation of buffers and reagents.
5. Titration curve of amino acid and calculation of pK and pI values.
6. Estimation of Carbohydrates by Anthrone method.
7. Estimation of Amino acids by Ninhydrin method.
8. Estimation of Proteins by Biuret method.
9. Estimation of Proteins by Lowry method.
10. Determination of Acid value, Saponification value and Iodine Number of Fat.
11. Estimation of Cholesterol by Liebermann – Burchard method.
12. Estimation of DNA by Diphenyl amine method.
13. Estimation of RNA by Orcinol method.

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Suggested Reading:

1. David, T. Plummer, "An introduction to Practical Biochemistry", 3rd edition, Tata McGraw Hill, 1988.
2. Beedu Sashidhar Rao and Vijay Deshpande, "Experimental Biochemistry - A student companion", Anshan Pub, 2006.
3. Sharma R.K., "Basic technique in Biochemistry and Molecular Biology", I.K. International Pvt. Ltd., New Delhi, 2008.

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16BT C11

MICROBIOLOGY 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 are made to understand the following experiments during their course of time:

1. Proper handling and focusing of Bright Field microscope.
2. Physical and chemical sterilization methods for control of microorganisms.
3. Preparation of culture media.
4. Techniques for the isolation of pure cultures.
5. Simple and Gram staining techniques.
6. Antibiotic sensitivity test by Disc Diffusion Method.

Course Outcomes

1. Outline of Magnification, Resolution, Refractive index of Microscope.
2. Operate the physical sterilization equipments.
3. Prepare the basic culture media for the growth of microorganisms.
4. Perform streak plate, spread plate and pour plate techniques.
5. Identify type of bacteria (Gram positive or Gram negative).
6. Evaluate sensitivity of microorganisms against different organisms.

List of Experiments:

1. Calibration of Microscope and Measurement of Microorganisms-Microtome.
2. Staining and Identification of microorganism: (a) Simple and Differential staining techniques.
3. Sterilization techniques (Autoclaving, Hot Air Oven, Radiation and Filtration).
4. Preparation of culture media (a) broth type of media (b) Agar.
5. Culturing of microorganism (a) broth (b) pure culture techniques-Streak plate, Pour plate.
6. Isolation and preservation of bacterial culture.

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7. Antibiotic tests- Disc diffusion method, minimum inhibitory concentration.
8. Biochemical tests- IMIVC test, Catalase, Coagulase test,

Gelatinase test, Oxidase.

9. Factors affecting the bacterial growth and study of growth curve.
10. Measurement of Microbial Growth (Viable Count and Turbidometry) and enumeration of bacterial numbers by serial dilution.
11. Coliform tes .

Suggested Reading:

1. Gopal Reddy M, M.N. Reddy, D.V.R. Sai Gopal and K.V. Mallaiah, "Laboratory Experiments in Microbiology", 3rd edition, Himalaya Publishing House Pvt. Ltd., 2008,
2. Gunasekaran P., "Laboratory manual in Microbiology", 3rd edition, New Age International Publ., New Delhi, 2007.
3. Kannan N., "Laboratory manual in General Microbiology", 1st edition, Panima Publishing Corp., New Delhi, 2002.
4. Alfred E. Brown, "Benson's Microbiological Applications: Laboratory manual in general microbiology", 12th edition, McGraw hill Education, 2011.

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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.

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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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
Choice Based Credit System
B.Tech (Bio-Technology)

SEMESTER – IV

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16BT C12	Chemical and Biochemical Thermodynamics	4	-	3	30	70	4
2	16BT C13	Molecular Biology	3	-	3	30	70	3
3	16BT C14	Immunology	3	-	3	30	70	3
4	16BT C15	Instrumental Methods in Biotechnology	3	-	3	30	70	3
5	16BT C16	Industrial Biotechnology	3	-	3	30	70	3
6	16MB C01	Engineering Economics and Accountancy	3	-	3	30	70	3
PRACTICALS								
7	16BT C17	Immunology Lab	-	3	3	25	50	2
8	16BT C18	Instrumental Methods in Biotechnology Lab	-	3	3	25	50	2
TOTAL			**19**	**6**	-	**230**	**520**	**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 internal assessment (Sessional) 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
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 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.

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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%.

16BT C12

CHEMICAL AND BIOCHEMICAL THERMODYNAMICS

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. Course aims at developing to reason so that students can apply thermodynamic principles in the solution of practical problems.
2. The aim of the course is also to give students an understanding of equilibrium conditions of chemical and biochemical extractions.
3. The course aims to give students the concepts of the transfer of chemical species between phases.
4. The course aims to facilitate students to apply I and II law of thermodynamics to open and closed systems to turbines and heat engines.
5. The course aims to give students the knowledge to calculate oxygen consumption and heat evolution in aerobic cultures.

Course Outcomes

1. Students will be able to measure heat and work increments for closed systems and cyclic processes.
2. Students will be able evaluate nozzle , turbine and compressors based on the principles of I-law of thermodynamics.
3. Students will be able to calculate coefficient of performance of heat engines and heat pump.
4. Students will be able predict the extent of various reactions by Gibbs and Duhem equation.
5. Students will be able to calculate separation processes like distillation based on vapour liquid equilibrium for binary systems.
6. Students will be able to calculate equilibrium conversions and yields of bio reactions.

UNIT I:

INTRODUCTION TO THERMODYNAMICS

System: Definition and Classification of system - closed and open system based on number of components, exchange of mass and heat. State and Path Functions, equilibrium, Phase rule. Thermodynamic Properties of fluids. Forms of energy, classification of properties. I-Law of Thermodynamics, application of I-law to closed, systems.

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Volumetric Properties of Fluids: PVT behaviour of pure fluids. Real and Ideal Gas. Equations of state - Ideal gas law, Virial equations of state (restricted to first two terms). Cubic equations of state - Van der Waals and Redlich kwong. Processes involving ideal gases (isochoric, isobaric, isothermal, adiabatic, polytropic - simple applications).

UNIT II:

THE SECOND LAW OF THERMODYNAMICS

Second law of thermodynamics: Limitations to I-law, qualitative statement of Kelvin Plank and Clausius versions of II-law, entropy - definition, entropy and heat calculations for ideal gases. Maxwell relations - problems not included, Residual properties - definition (V^R, H^R, S^R, G^R - basic property relations for ideal gases, problems not included).

UNIT III:

SOLUTION THERMODYNAMICS

Partial molar properties - definition and simple applications involving calculation of partial molar properties for binary systems using analytical methods (no graphical method). Concepts of Chemical potential and fugacity (for pure species and species in solution). Lewis Randall rule, Raoult's law, Henry's law - Definition and simple applications. Excess properties - definition and fundamental relation for excess Gibbs free energy, (problems not included). Activity and activity coefficients, correlations to calculate activity coefficients - Margules, Van Laar and applications involving binary systems.

UNIT IV:

PHASE EQUILIBRIA AND CHEMICAL REACTION EQUILIBRIA

Phase Equilibria: Vapor-liquid equilibrium calculations for binary systems - P-x-y ,T-x-y diagrams, using simple Raonlt's law to binary mixture.

Chemical Reaction Equilibria: Equilibrium criteria for homogenous chemical reactions. Standard Gibbs energy change of reaction, Reaction co-ordinate -definition. Evaluation of equilibrium constant - numerical problems not included. Effect of pressure and temperature on equilibrium constant - qualitative treatment, simple problems involving temperature dependence of equilibrium constant. Calculation of equilibrium conversions and yields for single reactions.

UNIT V:

BIOENERGETICS

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Energetics of Metabolic Pathways, Energy coupling (ATP & NADH). Stoichiometry and energetic analysis of Cell Growth and Product Formation. Thermodynamics of microbial growth. Oxygen consumption and heat evolution in aerobic cultures. Energy balance equation for cell culture.

Text Books:

1. J.M.Smith, H.C.Van Ness and M.M.Abbott, "Introduction to Chemical Engineering Thermodynamics", 6th ed, TMH, 2003.
2. J.A.Roels, "Energetics and kinetics in biotechnology" , Elsevier, 1983.
3. Y.V.C.Rao, Revised edition, "An introduction to thermodynamics", Universities Press, 2004.

Suggested Reading:

1. Robert A.Alberty, "Biochemical Thermodynamics: Applications of Mathematica", John Wiley and Sons, 2006.
2. Stanley I. Sandler, "Chemical and Engineering Thermodynamics", 3rd Edition, Wiley, 1999.
3. K.V.Narayanan, "A Textbook of Chemical Engineering Thermodynamics", PHI Learning Pvt. Ltd, 2004.

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16BT C13

MOLECULAR BIOLOGY

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. Student is made to understand the basics of molecular biology, i.e. concept of structure of DNA and how that lengthy DNA strands packaged in Prokaryotes & Eukaryotes.
2. Students are taught the Replication of DNA and how it repairs after damage.
3. Students are enlightened about the mechanism of transcription by RNA polymerases.
4. Students are made aware of concept of Ribozyme. (Slicing and maturation of RNA).
5. Students are taught the structure of RNA's and Ribosome's, and how it translates the genetic information.
6. Students are made to understand the regulation of gene expression and Transposons.

Course Outcomes

1. Be able to describe the structure & functions of genetic material.
2. Be able to explain the how the DNA is packaged into chromosomes.
3. Be able to correlate the types of DNA damage & repair.
4. Be able to describe the mechanism of transcription and maturation of RNA to initiate translation.
5. Be able to describe the translation of genetic information into polypeptide.
6. Be able to describe the regulation of gene expression.

UNIT I:

STRUCTURE AND ORGANIZATION OF GENETIC MATERIAL

Structure of DNA - Watson and Crick's model; types of DNA - A-DNA, B-DNA, Z-DNA; difference between DNA and RNA; denaturation and renaturation of DNA, DNA packing - prokaryotes (nucleoid model), eukaryotes (nucleosome solenoid model), euchromatin, heterochromatin, role of histone and non histone proteins in structural organization of chromosomes; telomere and its importance; repetitive DNA, satellite DNA, pseudo genes, overlapping and split genes.

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UNIT II:

DNA REPLICATION AND REPAIR

Replication of DNA - semi conservative replication and its experimental evidences, enzymology of replication, continuous and discontinuous DNA synthesis, complex replication apparatus, unidirectional replication, bi-directional replication, rolling circle replication; DNA damage and repair: Types of DNA damages- deamination, alkylation, pyrimidine dimmers; DNA Repair mechanisms- photo reactivation, Excision repair, mismatch repair, recombination repair, SOS repair.

UNIT III:

MECHANISM OF TRANSCRIPTION

Structure of promoters- RNA polymerases of prokaryotic and eukaryotic organism; transcription- initiation, elongation and termination; post transcriptional processes of eukaryotic RNA; structure and functions of RNA- (rRNA, mRNA, tRNA, Sn RNA), prokaryotic and eukaryotic transcription. Processing of t-RNA, r-RNA, m-RNA splicing; concept of ribozyme, inhibitors of transcription.

UNIT IV:

MECHANISM OF TRANSLATION

Ribosome- structural features of prokaryotic and eukaryotic ribosome; genetic code-triplet code, cracking of genetic code, features of genetic code, wobble hypothesis; protein synthesis: translation in prokaryotes and eukaryotes- initiation of translation, elongation of polypeptide chain, termination of translation. post translation modification, inhibitors of protein synthesis.

UNIT V:

REGULATION OF GENE EXPRESSION AND TRANSPOSABLE ELEMENTS

Operon concept of prokaryotic gene regulation, inducible operon - lac operon, repressible operon - trp operon, attenuation, negative and positive control of transcription. Britten Davidson model for eukaryotic gene regulation, eukaryotic gene regulation - transcriptional level, processing level, translational level; transposable elements - insertion sequences, composite transposons, transposable elements of eukaryotes (Ac-Ds in Maize, Ty elements in Yeast and P elements in Drosophila).

Text Books:

1. David Freifelder, "Molecular Biology", 2nd edition, Narosa Publication, 2007. P. Rajasri
2. Harvey F. Lodish, "Molecular Cell Biology", 7th edition, W. H. Freeman., 2012.

Reference Books:

1. Burton E. Tropp, "Molecular Biology: Genes to proteins", 4th editions, Jones & Bartlett publishers, 2012.
2. Benjamin Lewin, Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick, "Lewin's Genes XI",
   Jones and Bartlett publishers, 2014.
3. Rastogi S.C., "Cell and Molecular Biology", 2nd edition, New Age International, 2006.

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16BT C14

IMMUNOLOGY

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. Students learn about the basic components and responses of Immune system.
2. Knowledge of Antigen and antibody and the application of Antigen and antibody reaction.
3. Importance of Antigen Processing and Presentation is emphasized.
4. Students understand significance of complement system and hypersensitivity.
5. The immunological basics for diseases is taught to the students.
6. Role of immunology in cancer therapy and vaccine is emphasized upon.

Course Outcomes

1. Identify Immune system components and how they work in a coordinated way.
2. Graduates apply the application of antigen-antibody interactions in development of medical diagnostic kits.
3. Analyze the Immune system related underlying causes in Allergies, Asthma and other hypersensitive reactions.
4. Graduate is acquainted with the diseases caused due to Immune system malfunctioning.
5. Explain to the Students, the Immune system related medical complications in transplantation and Cancers.
6. Graduates identify the role of immunology in vaccines development.

UNIT I:

IMMUNE SYSTEM

Introduction to immunity, t pes of immunity - innate and adaptive immunity, humoral and cell mediated immune response, hematopoiesis, cells of the immune system, organs of immune system - primary (bone marrow and thymus) and secondary (lymph node, spleen, MALT, GALT), molecules of immune system (cytokines, interleukins, interferons, chemokines).

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UNIT II:

ANTIGEN, ANTIBODY AND ITS INTERACTION

Antigen - immunogenicity and antigenicity, factors influencing immunogenicity, haptens and adjutants, epitopes; Immunoglobulin - structure, classes and function, antigenic determinants of immunoglobulin - isotype, allotype, idiotype, generation of antibody diversity, production of monoclonal antibodies by hybridoma technology and its applications. Strength of antigen antibody interaction, affinity, avidity, cross reactivity, precipitation, agglutination, immunoelectrophoresis, RIA, ELISA, western blotting, immunoprecipitation, immunofluorescence, FACS.

UNIT III:

ANTIGEN PROCESSING AND PRESENTATION

Major histocompatibility complex (MHC) - organization, classes and function; Antigen processing and presentation - role of antigen presenting cells, endogenous antigens (cytosolic pathway), exogenous antigens (endocytic pathway), presentation of nonpeptide antigen.

UNIT IV:

THE COMPLEMENT SYSTEM AND HYPERSENSITIVITY

Complement system - components, function, activation (classical and alternative pathway); Hypersensitive reactions - Type I (IgE mediated hypersensitivity), type II (antibody mediated cytotoxic hypersensitivity), type III (Immune complex mediated hypersensitivity), type IV (delayed type hypersensitivity).

UNIT V:

MEDICAL APPLICATIONS OF IMMUNOLOGY

Autoimmunity - organ specific (insulin dependent diabetes mellitus, Graves' disease, myasthenia gravis) and systemic (systemic lupus erythematosus, multiple sclerosis, rheumatoid arthritis) autoimmune diseases, treatment of autoimmune diseases; Transplantation - immunological basis of graft rejection, immunosuppressive therapy (general and specific), immunoprophylaxis (attenuated, inactivated and DNA vaccines), immunology of cancer- tumour antigens, immune response to tumour, cancer immunotherapy.

Text Books:

1. Judith A. Owen, Jenni Punt, Sharon A.Stranford, "Kuby Immunology", 7th edition, W.H. Freeman, 2013.
2. Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt, "Roitt's Essential Immunology", 12th edition, John Wiley & Sons, 2011.

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Suggested Reading:

1. Kenneth Murphy, "Janeway's Immunobiology", 8^{th} edition, Garland Science, 2011.
2. Abdul K. Abbas, Andrew H. Lichtman, Shiv Pillai, "Cellular and Molecular Immunology 7^{th} edition", Elsevier Health Sciences, 2011.
3. Sunil Kumar Mohanty and K. Sai Leela, "Text book of Immunology", 2^{nd} edition, JP Medical Ltd, 2014.

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16BT C15

INSTRUMENTAL METHODS IN BIOTECHNOLOGY

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 are made to understand the following concepts during their course of time:

1. Types of Analytical methods and Instruments used for Analysis, Importance of microscopy.
2. Types of Instruments used for isolation of Biomolecules and Sub cellular organelles.
3. Types of centrifuges like low speed, high speed, ultra centrifuges.
4. Types of Chromatographic Techniques.
5. Charge based separation Techniques.
6. Spectrometric identification Techniques.

Course Outcomes

1. Solve the Analytical problems in instruments by Detection & sensitivity limits.
2. Assess the merits and demerits of instruments.
3. Discuss Principle, procedure and applications of different types of centrifugation.
4. Summarize Principle, Procedure and applications of chromatography's like TLC, paper.
5. Explain Principle procedure and applications of different electrophoresis like SDS, Agarose.
6. State the basic concepts of spectroscopy, Beers Lamberts law, Colorimeter, Nephlometry.

UNIT I:

ANALYTICAL METHODS AND MICROSCOPY

Types of Analytical Methods - Instruments for Analysis - Uncertainties in Instrumental measurements - Sensitivity and detection limit, accuracy and precision for instruments. Principle, procedure and applications of Bright field, Dark field, fluorescent and electron microscopy.

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UNIT II:

INSTRUMENTS FOR ISOLATION TECHNIQUES

Cell disruption by French press, sonication, freeze thaw technique, use of liquid N2 and chemical approaches involved in cell disruption. Isolation of Biomolecules and cell organelles. centrifugation: basic principles of sedimentation, sedimentation coefficient, Svedberg Unit. Various types of centrifuges, their uses, rotors, fixed angle, vertical, swing bucket, zonal rotors. Preparative centrifugation, differential density gradient centrifugation, analytical ultra centrifugation. Materials used in preparation of density gradient- sucrose & cesium chloride.

UNIT III:

SEPARATION TECHNIQUES

Partition coefficient, partition chromatography, adsorption chromatography, Paper, TLC& GLC, adsorption media, solvent, continuous and gradient elution, fraction collection and detection of pure molecules. Methods based on size: Gel permeation chromatography, principle application- Molecular weight determination. Dialysis and its significance. Affinity chromatography, application & technique for purification of proteins and nucleic acids.

UNIT IV:

CHARGE BASED SEPARATION TECHNIQUES

Principle and application of Ion exchange chromatography, use of ion exchange- cation & anion exchangers, pH and salt gradients for elution of proteins, amino acids and nucleotides. Electrophoresis: Migration of charged molecules in electric field-moving boundary, paper, cellulose acetate, starch gel electrophoresis, SDS PAGE, Determination of molecular weight. Identification of specific proteins by western blotting. Agarose gel electrophoresis-separation of DNA recovery of DNA fragments from agarose gels, southern & northern blot techniques and their significance, pulse field gel electrophoresis.

UNIT V:

SPECTROMETRIC IDENTIFICATION TECHNIQUES

Basic concepts of spectroscopy, Visible & UV spectroscopy Beer lamberts law. Principles and application of Colorimetric & Flame photometry, Nephlometry. Principles and applications of Atomic absorption Spectrophotometer. Principles & applications of IR, ESR NMR & Mass spectroscopy.

Text Books:

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1. Keith Wilson and John Walker, "Principles and Techniques of Biochemistry and Molecular Biology", 6th edition, Cambridge University Press, 2005.

2. Sivasankar, "Instrumental Methods of Analysis", Oxford higher education, OUP, India, 2012.

Suggested Reading:

1. GW Ewing, "Instrumental Methods of Chemical Analysis", 4th edition, Mc Graw Hill, 1985.
2. D. Muralidhara Rao, A V N Swamy, Dhaneeswar Reddy, "Instrumental Methods of Analysis", CBS Publishers, 2013.
3. Skoog DA, "Fundamentals of Analytical Chemistry", Thomson Brooks/Cole, 2004.

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16BT C16

INDUSTRIAL BIOTECHNOLOGY

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. Student is made to discuss the scope and development of biotechnology and its products and made realized about the role of bioprocess engineer in biotechnological industries.
2. Students are taught the concepts, tools and techniques used in biotechnology.
3. Students are enlightened about fermenter and its process controls.
4. Students are taught about the production of primary and secondary metabolites used in day today life from different microorganisms.
5. Students are taught about the productions of commercial bioproducts such as beverages, enzymes, recombinant proteins having industrial and diagnostic importance.
6. Students are taught about the bioproducts that are used in agricultural, food and pharma ceutical industries.

Course Outcomes:

1. Student will be able to analyze the scope and evaluate development of biotechnology and its products.
2. Student will be able to use the concepts, tools and techniques for designing the solutions for complex biological problems.
3. Be able to use fermenter for the production of bioproducts.
4. Be able to apply the theoretical knowledge of production procedures for producing the bioproducts practically.
5. Be able explain the applications of different bioproducts.
6. Be able to apply the knowledge to face the challenges when placed in industry.

UNIT I:

INTRODUCTION TO BASICS OF BIOTECHNOLOGY

A historical overview on scope and development of biotechnology and products; biotechnology as an interdisciplinary enterprise; a brief survey of organisms, processes, products; areas of application of biotechnology.

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UNIT II:

INTRODUCTION TO INDUSTRIAL BIOPROCESSES

Role of a bioprocess engineer in the biotechnology industry; introduction, development and maintenance and characterization of industrial microorganisms; primary and secondary screening of inoculum, starter and industrial cultures, analysis of microbial fermentation processes; batch and continuous fermentations, solid state fermentation; an overview of aerobic and anaerobic fermentation processes.

UNIT III:

PRODUCTION OF MICROBIAL METABOLITES

A brief outline of processes for the production of some commercially important organic acids (e.g. citric acid and lactic acid); amino acids (glutamic acid and lysine); alcohols (ethanol, and n-butanol). Production of beverages (beer, wine) Study of production processes for various classes of low molecular weight secondary metabolites-" antibiotics -classification of antibiotics, production of penicillins.

UNIT IV:

PRODUCTION OF MICROBIAL ENZYMES AND RECOMBINANT PROTEINS

Production of commercially important industrial enzymes-proteases, amylases, lipases, cellulase, pectinase, and isomerase, production of recombinant proteins: insulin, interleukins, tumor necrosis factor and interferons.

UNIT V:

PRODUCTION OF MICROBIAL PRODUCTS

Bio-pesticides; bio-fertilizers and plant growth factors; natural biopreservatives (nisin); biopolymers (Xanthan gum and PHB); single cell protein; high fructose corn syrup;

Text Books:

1. Crueger W and Crueger A, Biotechnology: Text Book of Industrial microbiology. 2nd edition, Panima Publisher, 2005.
2. Casida L. E., Industrial Microbiology, 1st edition, New Age International, 2006.
3. Patel A.H., Industrial Microbiology, 6th edition, Mc Millan India ltd, 2007.

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Suggested Reading:

1. Samuel Cate Prescott, Cecil Gordon Dunn, "Industrial Microbiology", edition 2, Agrobios, India, 2009.
2. Bhatia S.C., "Industrial Biotechnology, Vol-I", Shree Publishers & distributors, 2011.
3. A V N Swamy, T.Md. Munawar "Basics of Industrial Bio-Technology", Lambert, 2013.

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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.

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.

16BT C17

IMMUNOLOGY 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. Students identifies significance of blood grouping.
2. The applications of Antigen antibody agglutination are demonstrated.
3. The applications of Antigen antibody Precipitation are demonstrated.
4. Students learn about diagnostic kits based on immunology.
5. Students learn to interpret results.
6. Students understand the significance of immunology and its application in medical arena.

Course Outcomes

1. Students are demonstrated how Antigens and Antibody interact.
2. The practical aspects of agglutination and precipitation are identified.
3. Student interprets the results based on the results of the antigen-antibody interaction.
4. Students analyze the importance of different Immunological techniques developed.
5. The importance of blood group matching in blood transfusions and other cases are practically demonstrated.
6. Graduates apply the practical implications of immunological based diagnostic kits.

List of Experiments:

1. ABO Blood Grouping and Identification of Rh typing.
2. Quantitative Precipitin Assay (QPA)(Rocket immuno electrophoresis).
3. Ouchterlony Double Diffusion for Antigen Antibody Patterns (ODD).
4. Immuno-electrophoresis (IEP).
5. Radial Immune Diffusion test (RID).
6. Widal test.
7. VDRL tests.

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8. Total and Differential count of RBC & WBC by Micropipette method.
9. Erythrocyte sedimentation rate.
10. Enzyme Linked Immunosorbent Assay (ELISA) for Antigen capture and Antibody capture.
11. Estimation of Immunoglobullins by Precipitation with Saturated Ammonium Sulphate

Suggested Reading:

1. Arti Nigam and Archana Ayyagari, Lab Manual in Biochemistry, "Immunology and Biotechnology", Tata McGraw Hill Education, 2007.
2. S. Ramakrishna and K.N. Sulochana, "Manual of Medical Laboratory Techniques", 1st edition, J.P. Medical Ltd, 2013.
3. Kanai L. Mukherjee and Swarajith Ghosh, "medical Laboratory Techniques, (Vol-I): Procedure Manual for Routine Diagnostic tests", 2nd edition, Tata McGraw Hill education.

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16BT C18

INSTRUMENTAL METHODS IN BIOTECHNOLOGY 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 are made to understand the following concepts during their course of time:

1. Demonstrate the pH meter and its function.
2. Verification of Beers Lamberts law using visible spectrophotometer.
3. Estimation of concentration of protein by Biuret method.
4. Separation of amino acids by TLC and Paper chromatography.
5. Demonstrate the Biosensors (Glucometer) and its function.
6. Separation of proteins in an unknown sample mixture by SDS-PAGE.

Course outcomes:

1. Adjust the pH of any analytical sample solution by using pH meter.
2. verify Beers Lamberts law using potassium di chromate solution.
3. Determine the concentration of unknown protein sample using visible spectrophotometer.
4. Separate and identify amino acids present in a sample mixture.
5. Demonstrate random blood glucose levels by using Accu-check Active Glucometer.
6. Separate the proteins present in sample mixture based on molecular weight.

List of Experiments:

1. The calibration of pH meter and measurement of pH for different solutions.
2. Estimation of Ascorbic acid by colorimetric assay.
3. Estimation of unknown samples by using conductivity meter.
4. Estimation of different macromolecules by visible spectrophotometer.
5. Verification of Lambert - Beers law by UV -VIS spectrophotometer.
6. Estimation of proteins and nucleic acids by U.V method.
7. Estimation of turbidity using Nephlometer.
8. The separation of different macromolecules by Paper, Thin layer chromatography.

9. The separation of different macromolecules by Paper, PAGE, SDS-PAGE.
10. Estimation of minerals by Flame photometry.
11. Estimation of Thiamine and Riboflavin by Fluorimetry.
12. Preparation of Standard curve using UV-VIS & Flame Photometry.
13. Fractionation of Plasma Proteins by Electrophoresis.
14. Subcellular fractionation studies by differential centrifugatio .

Suggested Reading:

1. Sivasankar, "Instrumental Methods of Analysis", Oxford higher education, OUP, India. 2012.
2. Dr.A.V.N.Swamy,D.Dharaneeswara Reddy, D.Muralidhara Rao, "Instrumental Methods of Analysis", CBS Publishers & Distributors Pvt. Ltd., Delhi, India, 2013.

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CHAITANYA BHARATHI INSTITUTE OFTECHNOLOGY (A)

Choice Based Credit System (with effect from 2018-19)

B.Tech (Bio-Technology)

S.No	Course Code	Title of the Course	Scheme of Instruction: Hours per week		Scheme of Examination			Credits
					Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16MT C08	Biostatistics	3	-	3	30	70	3
2	16BT C19	Fluid Mechanics and Heat Transfer	3	-	3	30	70	3
3	16BT C20	Protein Engineering and Enzyme Technology	4	-	4	30	70	4
4	16BT C21	Genetic Engineering and rDNA Technology	3	-	3	30	70	3
5	16BT E22 16BT E23 16MT E02	**Elective-I** 1. Environmentl Biotechnology 2. Food Biotechnology 3. Computational Numerical Methods	3	-	3	30	70	3
6	18CS E02 16BT E24 16BT E25	**Elective-II** 1. Python for Bioinformatics 2. Virology 3. Metabolic Engineering	3	-	3	30	70	3
PRACTICALS								
7	16BT C26	Fluid Mechanics and Heat Transfer Lab	-	3	3	25	50	2
8	16BT C27	Enzyme Technology Lab	-	3	3	25	50	2
9	16BT C28	Genetic Engineering Lab		3	3	25	50	2
		Total	19	9		255	570	25

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BIOSTATISTICS

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

Course Objectives:

1. Explain and apply principles of design, data collection and represent the data graphically.
2. Understand properties of the normal curve.
3. Infer properties of a population from a sample.
4. Compute simple probabilities of events.

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

1. Demonstrate the ability to apply fundamental concepts in exploratory data analysis.
2. Understand the concept of the sampling distribution of a statistic, and in particular describe the behavior of the sample mean.
3. Understand the foundations for classical inference involving. confidence intervals and hypothesis testing.
4. Apply inferential methods relating to the means of Normal distributions.
5. Demonstrate an appreciation of one-way analysis of variance (ANOVA).

UNIT – I DESCRIPTIVE STATISTICS

Types of data – Methods of collection of data-Graphical representation of data-Histogram-frequency polygon-Pie chart. Frequency distribution-Measures of central tendencies - Measures of dispersion (mean deviation and standard deviation) coefficient of variation and its significance Measures of dispersion-Skewness-Kurtosis-Boweyl's coefficient-Karl Pearson's coefficient of skewness- correlation-Lines of regression- applications of Biotechnology.

UNIT - II PROBABILITY

Classical approach- Axiomatic approach of probability. Basic theorems - addition and product theorem, conditional probability-Baye's theorem- applications to Biotechnology.

UNIT – III PROBABILITY DISTRIBUTIONS

Random variable- types of Random variable-probability mass function-probability density functions-Expectation, variance, co variance and their properties.

Probability function-Moment generating function (M.G.F), Cumulant generating function (C.G.F) and Characteristic function (CF). Discrete Distributions-Binomial distribution, Poison distribution-their expectation, M.G.F, C.G.F and

CF Continuous distributions: Normal Distribution- mean, variance, M.G.F and C.G.F. Properties of Normal distribution.

UNIT- IV INFERENCIAL STATISTICS I

Estimation-Hypothesis-Testing of Hypothesis-Types of Errors. Testing the single sample mean (αknown), Testing of single sample mean (σunknown).Testing the single sample proportion- single sample variance.

Testing the differences between two means, two proportions and two variances.

UNIT-V INFERENCIAL STATISTICS II

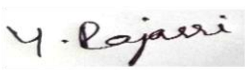
Testing of many proportions-χ^2 – test independent of attributes-r x c-tables. Analysis of variance-CRD.

Text Books:

1. Introduction to Bio-Statistics and Research Methods, by P.S.S Sunder Rao and J.Richard; fifth edition, PHI Learning Pvt. Ltd.2012.
2. Fundamentals of Applied Statistics by S.C.Gupta and Dr.V.K.Kapoor, Tenth edition, Publishers: Sultan Chand & Sons.

Suggested Reading:

1. Methods in Bio-Statistics by Mahajan, Japee Brothers Publishers, 2002
2. Text Book of Bio-Statistics; by A.K.Sharma Discovery Publishing House, 2005-Edition.
3. Fundamentals of Mathematical Statistics A Modern Approach, by S.C.Gupta and Dr.V.K.Kapoor, 10th edition, Publishers: Sultan Chand & Sons.



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16BT C19

FLUID MECHANICS AND HEAT TRANSFER

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

Course Objectives:

1. This course aims at providing knowledge on basic concepts in flow of fluids, flow field, flow past immersed bodies.
2. The course is designed to give an understanding on measurement of viscosity, flow measuring devices.
3. The course also deals with basic concepts in heat transfer, evaporation and condensation.

Course Outcomes: At the end of the course the students should

1. Be able to measure viscosity of different fluids.
2. Explain the functions of different flow measuring and monitoring devices.
3. Enable to calculate friction in flew process.
4. Enable to calculate pressure drop in flow process.
5. Calculate the heat transfer area, overall heat transfer co-efficient required for various processes.
6. Explain the operation of various, evaporators, condensers, heat exchange equipment.

UNIT-I BASIC CONCEPTS IN FLOW OF FLUIDS

Introduction, Nature of fluid, Rheology of fluids -Newton's law of viscosity. Concept of Newtonian and non-Newtonian fluids-Different types of non-Newtonian fluids with examples in bioprocessing. Measurement of viscosity using extrusion rheometer, plate and cone viscometer, coaxial cylinder viscometer etc.

UNIT-II FLOW FIELD

Friction losses in laminar flow through a circular tube (Hagen-Poiseuille equation), Friction losses in turbulent flow (Fanning equation), Pumping of fluids flow through pipes, average velocity, flow regimes, boundary layer concept. Laminar and turbulent flow -characterization by Reynold's number, pressure drop due to skin friction and form friction, friction factor chart, Hagen - Poiseuille equation.

UNIT-III FLOW PAST IMMERSED BODIES

Definition of drag and drag coefficient. Friction in flow through beds of solids, Brief introduction to flow of compressible fluids. Flow measuring and monitoring systems- valves, bends, elbows, prevention of leaks, mechanical seals, stuffing box. Flow measuring devices-manometers, orifice-meter, venturimeter and rotameter. Brief description of Pumps and Blowers.

UNIT-IV BASIC CONCEPTS IN HEAT TRANSFER

Introduction and Mechanisms of heat transfer; Conduction heat transfer (through slab, cylinder & Sphere); Conduction through solids in series, Forced convection heat transfer inside pipes, Introduction to radiation heat transfer, Chilling and freezing of food and Biological materials. Heat transfer correlations, and calculations, basic heat exchange equipment.

UNIT-V BASIC CONCEPTS IN EVAPORATION AND CONDENSATION

Introduction, Types of evaporation equipment and operation methods; Overall heat transfer coefficients in evaporators; simple material balances. Calculation methods for single effect evaporators, Evaporation of biological materials. Types of condensation, numerical problems and condensation equipment.

Text books:

1. W L McCabe and JC Smith, "Unit operations in Chemical Engineering", 6^{th} edition., McGraw Hill Intl. Ed, 2005.
2. Christie J. Geankoplis, "Transport Processes and Unit Operations", 3^{rd} edition, Prentice Hall India Pvt. Ltd.

Suggested Reading:

1. Kothandaraman CP and Rudramoorthy. R, "Basic Fluid Mechanics", New Age International Publishers, New Delhi, 1998.
2. Sachdeva RC, "Fundamentals of Engineering Heat and Mass Transfer", New Age International Publishers, New Delhi, 1996.

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16BT C20

PROTEIN ENGINEEERING AND ENZYME TECHNOLOGY

Instruction	4L Periods per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Sessionals	30 Marks
Credits	4

Course Objectives:

1. The course aims at providing knowledge about structure and functions of proteins.
2. To understand the synthesis of proteins and analytical techniques for protein.
3. To learn the commercial applications of enzymes in diverse fields namely medicine, food industry, diagnostic industries.
4. To learn the role of enzyme kinetics and its action.
5. To understand the methods of enzyme immobilization and its mass transfer kinetics.

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

1. Explain structure properties and functions of proteins.
2. Outline protein isolation and analytical techniques.
3. Identify engineered proteins and its applications.
4. Discuss the applications of enzymes in different fields.
5. Explain the kinetics of enzyme action.
6. Compare various enzyme immobilization techniques and its mass transfer effects.

UNIT- I PROTEIN STRUCTURE AND FUNCTIONS

Peptide bond- Structure, functions; Proteins-classification and Biological functions; Physico-chemical properties, forces stabilizing protein structure - primary structure, secondary structure (á-helical, â-pleated sheets), super secondary structures, Ramachandran Plot, tertiary and quaternary structure; Myoglobin, Lysozyme, Ribonuclease A, Hemoglobin; Fibrous protein (Collagen).

UNIT- II PROTEIN SYNTHESIS AND PROTEIN DESIGN

Methods of protein isolation, purification and quantification; Chemical synthesis of peptides – Solid phase and liquid phase synthesis; Methods of detection (peptide mass fingerprinting, MALDI-TOF); Protein engineering strategies (Rational protein design & Directed evolution) and applications.

UNIT- III PRODUCTION AND APPLICATIONS OF ENZYMES

Enzyme nomenclature and classification of enzymes; Production and purification of crude enzyme extracts from plant, animal and microbial sources; Development of enzymatic assays; Applications of commercial enzymes; Proteases; Amylases; Lipases; Cellulases; Pectinases; Isomerases in food, pharmaceutical and other industries; Enzymes for analytical and diagnostic purposes; Design of enzyme electrodes and their application as biosensors in industry, health care and environment.

UNIT- IV MECHANISMS AND KINETICS OF ENZYME ACTION

Mechanisms of enzyme action; Concept of active site and energetics of enzyme substrate complex formation; Specificity of enzyme action; Kinetics of single substrate reactions; Turn over number; Derivation of Michaelis -Menten equation; Multi substrate reaction mechanisms ; Types of Enzyme Inhibition; Allosteric enzymes.

UNIT - V ENZYME IMMOBILIZATION & MASS TRANSFER EFFECTS IN IMMOBILISED ENZYME SYSTEMS

Physical and chemical techniques for enzyme immobilization - adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding; Advantages and disadvantages of different immobilization techniques; Overview of applications of immobilized enzyme systems; Analysis of Film and pore Diffusion Effects on kinetics of Immobilized Enzyme Reactions; Formulation of dimensionless groups and calculation of Effectiveness Factors.

Text Books:

1. Trevor Palmer, Philip Bonner, “Enzymes”, 2nd edition, Woodhead Publishing, 2007.
2. J.L. Jain, “Fundamentals of Biochemistry”, revised edition, Chand (S.) & Co Ltd, India, 2016.

Suggested books:

1. Voet and Voet J.G, “Biochemistry”, 4nd edition, John C.Wiley and Sons, 2010.
2. **Andreas S.** Bommarius and Bettina R. Riebel, “Biocatalysis - Fundamentals and Applications”, Wiley-VCH, 2004.

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16BT C21

GENETIC ENGINEERING AND rDNA TECHNOLOGY

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

Course Objectives

1. To provide theoretical concepts, basic principles and tools used in rDNA technology.
2. To learn essential features and various vectors used in gene cloning and rDNA technology.
3. To describe the principle, methodology and applications of PCR and molecular markers.
4. To outline the range of cloning strategies that are employed to clone a DNA sequence.
5. To describe how rDNA is used to produce proteins.
6. To illustrate the impact of rDNA technology on biotechnology applications.

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

1. Explain the basic principles and tools used in rDNA research starting from isolation of nucleic acid, enzymes etc.
2. Compare various types of cloning vectors and expression vectors and their use in rDNA technology.
3. Discuss about PCR, and its applications and molecular markers.
4. Predict various cloning strategies used in rDNA technology.
5. Identify high level expression of protein in different host systems
6. Apply gene cloning and rDNA technology in various fields.

UNIT-I: ISOLATION AND PURIFICATION OF DNA AND ENZYMES USED IN CLONING

Isolation and purification of DNA; Host controlled restriction and modifications; Enzymes used in cloning - **Restriction endonuclease, Polymerases, Ligase, Phosphatase, Kinase, Nuclease;** Restriction mapping; Blotting techniques – Southern, Northern and Western Blotting.

UNIT- II: CLONING VEHICLES

Essential features of cloning vectors; Cloning vectors - Plasmid vectors - pBR 322, pUC 18/19; Phage vectors – ëZAP, ëEMBL4; M13 derived vectors – M13mp18; Phagemid- Blue script vectors; Cosmid- pJB8; Artificial chromosomes - BAC, YAC; Expression vectors - pET vectors.

UNIT- III: POLYMERASE CHAIN REACTION AND MOLECULAR MARKERS

PCR – Principle, Designing of primers, PCR Methodology, RT-PCR, Multiplex PCR, PCR for site directed mutagenesis, Applications of PCR; Molecular marker – RFLP, RAPD, AFLP.

UNIT- IV: CLONING STRATEGIES

Construction of genomic and cDNA libraries; Basic concept of blunt end and cohesive end ligation, homopolymer tailing, use of linkers, adaptors. Introduction of cloned genes into hosts- Transformation, Transfection, packaging phage DNA *In vitro*; Detection of clones with desired gene; Methods of gene sequencing: - Maxam and Gilbert method, Sanger's dideoxy chain termination method, Pyrosequencing, automation of DNA sequencing.

UNIT- V: EXPRESSION OF RECOMBINANT PROTEINS AND APPLICATIONS OF rDNA TECHNOLOGY

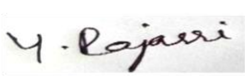
High level expression of proteins in different host systems in *E. coli*, yeast, Insect and mammalian cells; Applications of Gene cloning and rDNA Technology - Recombinant Insulin, Recombinant Factor VIII, Golden rice. Introduction to Gene therapy (*Ex vivo* & *In vivo*), case study of ADA as an example. Safety guidelines for rDNA research.

Text books:

1. Brown TA, "Gene Cloning and DNA Analysis: An Introduction", 7th edition., Wiley Blackwell , A John Wiley & Son Ltd publications, UK, 2015.
2. Primrose SB and Twyman RM, "Principles of Gene manipulation and Genomics", 7th edition, John Wiley & Sons, 2013.

Suggested Reading:

1. Glick BR, Pasternak JJ and Patten CL, "Molecular Biotechnology: Principles and applications of Recombinant DNA", 4th edition, ASM Press, 2010.
2. Desmond S T Nicholl, "An Introduction to Genetic Engineering", 3rd edition, Cambridge End Press, 2008.
3. Richard J. Reece, "Analysis of Genes and Genomes", Wiley, 2004.



16BT E22

ENVIRNOMENTAL BIOTECHNOLOGY

(Elective –I)

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

Course Objectives

1. To provide theoretical concepts and a comprehensive knowledge on bioremediation methods.
2. To provide knowledge on metal leaching and non conventional fuels.
3. To impart theoretical basics on various methods used in treatment of waste water.
4. To provide knowledge on degradation of Xenobiotic compounds.
5. To update the students with the available information on biotechnological applications in hazardous waste management.

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

1. Discuss bioremediation in detail.
2. Use of Microorganisms for metal leaching and biofuels.
3. Out line the different methods for waste water treatment.
4. Explain the importance of Xenobiotics in nature.
5. Analyze hazardous waste disposal.
6. Demonstrate the role of biotechnology in dealing with environmental problems.

UNIT – I: BIOREMEDIATION

Introduction; Constraints and priorities of Bioremediation, Biostimulation of naturally occurring microbial activities Bio-augmentation; *In situ, Ex situ*, Intrinsic and Extrinsic Bioremediation; Solid phase bioremediation- Land farming, composting , Biopile. Phyto-remediation techniques, Liquid phase bioremediation.

UNIT – II: METAL BIOTECHNOLOGY AND BIOFUELS

Introduction to metal biotechnology; Microbial transformation; Biosorption, Metal leaching; Metal Extraction and future prospects. Microorganisms and their role in energy requirements of mankind. Role of carbon credits in Industries. Production of non-conventional fuels: Methane (Biogas), Hydrogen, Alcohols and Algal Hydrocarbons.

UNIT – III: BIOLOGICAL WASTE WATER TREATMENT

Biological processes for domestic and industrial waste water treatment. Aerobic systems – Activated sludge process, trickling filters, Biological filters, Rotating biological contractors (RBC), Fluidized bed reactor (FBR), Expanded bed reactor, Inverse fluidized bed bio-film reactor (IFBBR). Anaerobic biological treatment-Contact digesters, Packed column reactors, UASB.

UNIT- IV: DEGRADATION OF XENOBIOTIC COMPOUNDS

Introduction- Xenobiotic compounds; Recalcitrants; Biodegradation of Xenobiotics present in Environment. Degradative plasmids; Oil Pollution and Bioremediation of Contaminated soils. Biological Detoxification-Cyanide detoxification, Detoxification of Toxic Organics and Phenols.

UNIT- V: HAZARDOUS WASTE MANAGEMENT

Hazardous Waste, Biotechnological applications to hazardous waste management. Global Environmental problems and Biotechnological approaches for management. Nuclear waste generation and treatment.

Text books:

1. Alan Scragg "Environmental Biotechnology", 2nd edition , Oxford End Press, 2005.
2. Foster CF, John Ware DA, "Environmental Biotechnology", Ellis Horwood Ltd. 1987.

Suggested readings

1. Stanier RY Ingram JL., Wheelis ML & Painter RR "General Microbiology" Mcmillan Publications, 1989
2. Environmental Biotechnology By Priv.-Doz. Dr.Hans-Joachim Jördening, Prof. Dr. Josef Winter, Wiley-VCH Verlag GmbH & Co. KGaA. 2005.
3. John. T. Cookson "Bioremediation Engineering: Design And Application" by, Jr. Mc Graw Hill, Inc. 1995.

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16BT E23

FOOD BIOTECHNOLOGY

(Elective-I)

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

Course Objectives:

1. Student is made to understand the importance of food biotechnology and its nutritive value.
2. Students are taught the types of food available in the nature and its consumption value.
3. Students made to understand the food spoilage.
4. Students are enlightened about the importance of food processing.
5. Students are made aware of chemical and physical methods of food processing.
6. Student is made to understand the methods of food preservation and its control in food spoilage.

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

1. Apply the fundamentals of food biotechnology to their real life situation.
2. Differentiate types of food and explain their consumption value.
3. Describe the types of pathogens and their effect on food.
4. Describe the physical and chemical methods of food processing.
5. Be in a position to preserve the food material to avoid food spoilage.
6. By understanding the principles of biotechnology able to work in a suitable food industry.

UNIT-I SCOPE AND IMPORTANCE OF FOOD BIOTECHNOLOGY

Introduction to Scope and importance of food biotechnology, Nutritive value of the food ; consumption and structure of foods and the importance of industrial processing of foods, various technologies and methods in food preservation, processing and packaging, food grade polymers.

UNIT- II FOOD PRODUCTS

Introduction to Probiotics, Nutraceuticals and GM foods ; Development of Industrial Food products: High Fructose Corn syrup, Single Cell Protein and Fermented foods, Bakery Products, Beverages, Milk Products and Mushroom Development; Food labeling.

UNIT- III FOOD SPOILAGE AND FOOD MICROBIOLOGY

Food spoilage, Bacterial agents of food borne illness; Clostridium, Salmonella, Vibrio and Shigella, non bacterial agents; Protozoa, Algae, Fungi and Viruses.

UNIT- IV FOOD PROCESSING

Bio-processing : Enzymes and chemicals used in food processing for flavor development; Processing of meat, fisheries, vegetables, dairy products; Thermal processing of foods; Microwave heating; Thermal inactivation of microorganisms; Freezing and thawing methods of food processing.

UNIT- V FOOD PRESERVATION

Food preservation using Irradiation: Characteristics of Radiations of Interest in food preservation, Principles underlying the destruction of microorganisms by irradiation, Processing of foods for Irradiation, Legal status of food irradiation, Effect of Irradiation of Food constituents and Storage Stability; Food Preservation with low and High Temperatures and Preservation of foods by Drying, equipment for Drying.

Text Books:

1. Roger Angold, Gordon Beech & Taggart, "Food Biotechnology" 1st edition, Cambridge End Press, 1989.
2. Frazier, William, C.Westhoff, Dennisc, "Food Microbiology" 2nd Edition TATA Mcgraw Hill Publishers, 1989.

Suggested Reading:

1. Ashok Pandey, "Biotechnology:Food Fermentation" Asia Tech Publishers Inc,New Delhi,1999.
2. J.M.Jay, M.J.Loessner and D.A.Golden, "Modern food microbiology", 7th edition,Springer,2006.
3. Romeo T. Toledo, "Fundamentals of Food Process Engineering", 3rd edition, Springer, February, 2007.

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COMPUTATIONAL NUMERICAL METHODS
(Elective-I)

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

Course Objectives:

1. Learn interpolation and extrapolation techniques to fit the numerical tabulated data.
2. Solve numerical integration to get approximate solution of given date using Simpson's 1/3 rd, 3/8th Weddle's rules.
3. Solve numerical differentiation to get approximate solution of ODE using Taylor, Picard's , Euler's, modified Euler's , Runge kutta methods.
4. Solve algebraic and transcendental equations.
5. Solve simultaneous equations when the number of unknown increases by iterative methods and ill condition and well condition equations.

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

1. Learn interpolation and extrapolation techniques to fit the numerical tabulated date.
2. Solve numerical integration of given date using Simpson's 1/3 rd, 3/8th Weddle's rules.
3. Solve numerical differentiation to get approximate solution of ODE using Taylor, Picard's , Euler's, modified Euler's , Runga kutta methods.
4. Solve algebraic and transcendental equations.
5. Derive the solutions when system of equations has more than two unknowns and learn to reduce the instability of equations.

UNIT I: INTERPOLATION: Finite difference operators, Newton's forward and backward interpolation formulas, Newton's divided difference interpolation for unequal intervals,Lagrange's interpolation, inverse interpolation.

UNIT II: NUMERICAL DIFFERENTIATION & INTEGRATION: Numerical differentiation using Newton's forward & backward interpolation formulas, and Newton's divided difference interpolation formula. Numerical integration: Simpson's 1/3 rd, 3/8th rules. Weddle's rule.

UNIT III: NEMERICAL SOLUTIONS FOR DIFFENTIAL EQUATIONS: Solution of differential equation: Taylor's method, Picard's method, Euler's method, modified Euler's method, Runga kutta fourth order method.

UNIT-IV: Solutions of Algebraic and Transcendental Equations: Method of Bisection, Regulae Falsi Method (method of false position); Newton Raphson Method.

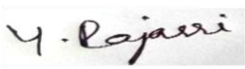
UNIT-V: Solutions of Simultaneous Equations: Gauss elimination method, Jacobi iteration Method, Gauss Serial Method of Iteration.

Text Books:

1. Numerical Methods by S. S. Shastry.
2. Numerical Analysis for Scientists and Engineers- by Mittal.
3. Numerical and statistical Methods in Computer by V.K.Singh.

Suggested Reading:

1. B.S.Grewal: Higher Engineering Mathematics, Hanna Publications.2 .Miller and Freund, Probability and Statistics for Engineers, PEARSON, 2005.
2. Erwyn Kreyszig: Advanced Engineering Mathematics.



18CS E02

Python for Bioinformatics
(Elective-II)

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

Course Objectives

1. Introduce Python with reference to bioinformatics.
2. Study Object-Oriented programming in Python.
3. Explain Biological sequence analysis using Python.
4. Describe advanced analysis techniques.
5. Describe expression and gene analysis using Python.

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

1. Understand the basics of Python Programming.
2. Develop applications using Python to solve problems.
3. Identify and use Python modules related to Biology.
4. Analyze biological sequences using Python.
5. Understand advanced analysis techniques.
6. Analyze gene expressions using Python.

Unit-I

Introduction to Python: Basics of Python, Python IDEs,,running Python programs, types and operations, Functions, modules, classes, Exceptions.

Unit-II

Object-Oriented Programming, Modules: Object Oriented Programming, Threads, process, synchronization, databases and persistence, NumPy, SciPy, Image manipulation, Akando and Dancer modules

Unit-III

Biological Sequence Analysis: Biopython: Parsing DNA data files, Sequence Analysis, Dynamic Programming, Hidden Markov Model, Genetic Algorithms, Multiple Sequence Alignment, gapped alignment.

Unit-IV

Advanced Analysis Techniques: Trees, Text Mining, Clustering, Self-Organizing Map, Principal Component Analysis, Numerical Sequence Alignment.

Unit-V

Expression Analysis: Gene expression array analysis, Spot finding and Measurement, Spreadsheet Arrays and Data Displays, Applications with expression Alignment.

Text Books:

1. Jason Kinser, “**Python for Bioinformatics**”, Jones & Bartlett Publishers, 2nd Edition, 2013.
2. ReemaThareja “**Python Programming**”, Oxford Press, 2017.

Suggested Reading:

1. Mark Lutz, “**Learning Python**”, 3rd edition, O’Reilly, 2007.
2. Alex Martelli, David Ascher, “**Python cookbook**”, O’Reilly, 2002.
3. http://www.biopython.org

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16BT E24

VIROLOGY

(Elective–II)

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

Course objectives:

1. Students are made to understand the morphology and genetics of viruses.
2. Students recognize the procedures for cultivation of plant & animal viruses.
3. Students are enlightened about the characterization of viruses.
4. Students are taught the ultra structure of bacteriophages.
5. Students are taught the replication of plant & animal viruses.
6. The concept of viral vaccines preparation is introduced to the students.

Course outcomes: At the end of the course the students are able to

1. Students understand the basic structure of viruses.
2. Students compare the techniques for cultivation of plant & animal viruses.
3. Students explain the pros & cons of characterization techniques of viruses.
4. Students illustrate the structure of different phages.
5. Student recognizes the differences between replication of plant & animal viruses.
6. Be able to understand the procedures in preparation of vaccines.

UNIT- I INTRODUCTION TO VIROLOGY

Brief outline of discovery of Viruses; Properties of Viruses; Morphology of Viruses- Structure, Capsid Architecture, Envelopes and peplomers; Chemistry of Viruses- Viral Proteins, Genome- Structure and Types; Study of sub viral agents- Brief account on Diseases caused by Viroids- PSTV, Cadang cadang; Prions- Scrape, Cruetzfeldy jakob. Satellite viruses.

UNIT- II CULTIVATION OF VIRUSES I

General methods of cultivation of viruses- in embryonated eggs, cultivation of animal and plant viruses; cultivation of bacteriophages, Isolation and purification of viruses- plant viruses, animal viruses; Criteria of purity, Maintenance and preservation of infectivity; Characterization of viruses- Electron microscopy, X-ray crystallography, sedimentation analysis;

UNIT- III CHARACTERIZATION OF VIRUSES II

Enumeration viruses- By electron microscopy, plaque assay, acid end point method, Haemagglutinin assay; Detection of viruses-By serological characterization, detection of viral antigen, detection of viral nucleic acid; chemical determination Ultra structure and life cycles of Bacteriophages- Ml3, T4 & lambda.

UNIT- IV PLANT VIRUSES

Taxonomy; Symptoms of diseases caused by plant viruses (Morphological, Physiological and Histological); Ultra structure and life cycles of TMV; transmission of plant viruses- Mechanical and biological (vector and non-vector); Basic control measures of plant diseases- vector and chemical control, biopesticides with examples.

UNIT- V ANIMAL VIRUSES

Taxonomy; Detailed structure and brief account on life cycles of RNA viruses- Polio, Influenza, Rota virus and HIV; Ultra structure and brief account on life cycles of DNA viruses- Vaccina, SV40 and Hepatitis Virus; Viral vaccines-types and preparation of conventional vaccines

Text Books

1. Dimmock NJ and Primrose SB, "Introduction to Modern Virology", 4th edition, Blackwell Scientific Publications, 1994.
2. Matthews REF "Fundamentals of Plant Virology". Academic Press, San Diego, 1992.

Suggested books

1. Carter J and Saunders V "Virology: Principles and Applications" John Wiley and Sons ltd, 2007.
2. Morag C, Timbury M, Chrchill Livingstone, "Medical Virology", London, 1994.

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16BT E25

Metabolic Engineering

(Elective–II)

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

Course Objectives:

1. To identify the different metabolic regulations.
2. To outline various pathways of Biosynthesis of secondary metabolic and their applications.
3. To identify factors and criteria for bioconversions and their applications.
4. To learn the concept of metabolic flux and its application.
5. To compute metabolic pathways and algorithms.
6. To identify various applications of metabolic engineering in pharma chemical bioprocess, agriculture etc.

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

1. Revise the regulations & requirements of metabolic engineering.
2. Analyze and design various pathways of biosynthesis of secondary metabolies & their applications in various fields.
3. Assess the criteria & factors necessary for bio concessions- and out line their applications.
4. Discuss the analysis & applications of metabolic.
5. Design algorithms metabolic pathway modeling synthesis using bioinformatics tools.
6. Assess and compute various applications of metabolic engineering different fields.

UNIT- I INTRODUCTION

Identification of metabolic regulation: a key point in Metabolic Engineering. Basic concepts of Metabolic Engineering- Overview of cellular metabolism, Different models for cellular reaction, induction, Jacob monad model & its regulation, Different regulation by Isoenzymes,feed back regulation. Amino acid synthesis, pathways with regulation at enzyme & cell level.

UNIT- II BIOSYNTHESIS OF SECONDARY METABOLITES

Regulation of secondary metabolic path ways, precursor effect, prophase, Idiophase –relationships. Catabolite regulation bypassing control of secondary metabolism, producers of secondary metabolites and their applications.

UNIT- III BIOCONVERSIONS

Factors affecting bioconversions, Specificity, Yields, Co metabolism, Product inhibition, mixed or sequential bioconversions, Conversion of insoluble substances. Applications of Bioconversions. Strain selection, Genetic improvement of strains, Gene dosage, metabolic pathway manipulations to improve fermentation. The modification of existing or the introduction of entirely new metabolic pathways.

UNIT- IV METABOLIC FLUX

Metabolic flux distribution analysis, Experiments determination method of flux distribution, Metabolic flux analysis and its applications.

UNIT- V METABOLOMICS & APPLICATIONS OF METABOLIC ENGINEERING

Metabolic pathway modeling, Analysis of metabolic control and the structure metabolic networks, Metabolic pathway synthesis algorithms. Application in pharmaceuticals, chemical bioprocess, food biotechnology, agriculture environmental bioremediation and biomass conversion.

Text Books:

1. Ste Phanopoulas.G.N “Metabolic Engineering Principles & Methodologies” , Academic Press-Elsevier,1998.
2. Wand.D.I.C Cooney C.L., Demain A.L., Dunnil.P.Humphrey A.E.Lilly M.D. “ Fermentation and Enzyme Technology, John Wiley and sons, 1980.
3. Metabolic engineering Sangy Yuplee and E.T.Pa poutsakis Marcel Dekker Inc.

Suggested Reading:

1. Zubay G., Biochemistry, Macmillan Publishers, 1989.
2. Stanbury P.F., and Whitaker A., Principles of Fermentation Technology Pergamon Press, 1984.

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16BT E26

FLUID MECHANICS AND HEAT TRANSFER LAB

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

Course Objectives:

1. This lab course is designed to understand the mechanics of fluid flow, analysis of various processes viz., Flow measuring devices Venturimeter, Mouth piece, and Triangular notch.), heat exchangers.

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

1. Course outcomes are based on a continuous evaluation basis, like viva voce, calculations etc., and a final exam.
2. Demonstrate various experimentation methods with skill and precision.
3. Determine Thermal conductivity of homogeneous wall.
4. Determine calculate heat transfer coefficient in unsteady state heat transfer.
5. Determine overall heat transfer coefficient in unsteady state heat transfer.
6. Determine friction losses in pipe fittings.

LIST OF EXPERIMENTS

1. Determination of discharge coefficient for orifice meter and venturi meter and their variation with Reynolds number.
2. Determination of weir meter constant K for v-notch and rectangular notch.
3. Calibration of rotameter and study of variation of flow rate with tube to float diameter.
4. Determination of viscosity of Glycerol - water solutions at different temperatures.
5. Determination of friction factor for flow of water through annulus using Farmings and Davos equations.
6. Determination of friction factor for flow through straight pipes of different diameters and study of variation of friction factor with Reynolds number.

7. Determination of friction losses in pipe fittings.
8. Determination of Thermal conductivity of homogeneous wall insulating powder under steady state conditions.
9. Determination of interface temperatures in composite wall under steady state conditions.
10. Determination of heat transfer coefficient in Natural convection.
11. Determination of overall heat transfer coefficient in unsteady state heat transfer.
12. Determination of inside heat transfer coefficient in coil heat exchangers.
13. Determination of overall heat transfer coefficient and effectiveness in a Double pipe heat exchange.
14. Determination of heat transfer area in a 1-2- shell and tube heat exchanges.
15. Determination of heat transfer coefficient on a single tube by film wise and drop wise condensation.

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16BT C27

ENZYME TECHNOLOGY LAB

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

Course Objectives:

1. The course aims at providing knowledge about the preparation of buffers and chemicals.
2. Outline for isolation and purification of enzymes.
3. Compare the optimum ranges of physical parameters for enzyme activity.
4. Compute the Michelis-Menten kinetics.
5. The students understand the methods of immobilization of enzymes and their kinetics.

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

1. Preparation of buffers.
2. Demonstrate the isolation of enzymes.
3. Predict the optimum ranges of parameters on enzyme activity.
4. Analyze the effect of various physical parameters and Michelis-Menten kinetics (K_s, V_{max}) activity of enzyme.
5. Choose the suitable methods for immobilization of enzymes.

LIST OF EXPERIMENTS

1. Preparation of buffers.
2. Isolation and extraction of enzymes (Microbial, plant and animal source).
3. Effect of pH on enzyme activity.
4. Effect of temperature on enzyme activity.
5. Effect of substrate concentration on enzyme activity.
6. Effect of time interval on enzyme activity.
7. Development of Enzyme Assay.
8. Evaluation of Michelis Menten kinetic parameters.
9. Kinetic studies of enzyme inhibition.
10. Determination of growth curve of a supplied microorganism and to determine substrate degradation profile.
11. Studies on immobilization of enzyme/cell by gel entrapment method.
12. Comparative study of activities of free and immobilized enzyme systems.

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16BT C28

GENETIC ENGINEERING LAB

Instruction	3P Periods per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Sessionals	25 Marks
Credits	3

Course objectives:

1. To provide an opportunity to experimentally verify the concepts of genetic engineering and rDNA technology already studied.
2. To provide hands on training to students to practically prove the theoretical concepts studied with respect to isolation, quantification, amplification, sequencing of DNA genome /fragments and analysis of recombinant protein from transformed bacterial cultures.

Course outcomes: At the end of the course the students are able to

1. Demonstrate isolation of nucleic acids.
2. Characterize the DNA by restriction digestion and restriction mapping.
3. Design polymerase chain reaction.
4. Plan different steps involved in cloning strategies.
5. Analyze and compute DNA Sequencing.
6. Analyze the recombinant protein by using SDS PAGE.

LIST OF EXPERIMENTS

1. Isolation of bacterial genomic DNA.
2. Isolation of plasmid DNA.
3. Visualization of Genomic and Plasmid DNA on Agarose gels.
4. Restriction digestion.
5. Restriction mapping of DNA fragments.
6. Gel elution.
7. DNA ligation.
8. Preparation of competent cells.
9. Genetic transformation and screening for recombinant bacterial cells.
10. Blotting techniques- southern blotting.
11. Amplification of DNA fragments by Polymerase Chain Reaction (PCR).
12. DNA sequencing- Sanger's Method.
13. Analysis of Recombinant Proteins using SDS-PAGE.

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Suggested Reading:. Green MR and Sambrook J, "Molecular Cloning-A laboratory manual", Vol I, II and III, Cold spring Harbor Laboratory Press, 2012

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Choice Based Credit System (with effect from 2018-19)
B.Tech (Bio-Technology)

SEMESTER – VI

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per week		Scheme of Examination			Credits
			L/T	P/D	Duration of SEE in Hours	Maximum Marks CIE	Maximum Marks SEE	
THEORY								
1	16BT C29	Fermentation Technology	4	-	4	30	70	4
2	16BT C30	Mass Transfer Operations	4	-	4	30	70	4
3	16BT C31	Bioinformatics	4	-	4	30	70	4
4	18CS E02 16BT E32 16BT E33	**Elective – III** 1. JAVA Programming and Bio-Java 2. Medical Biotechnology 3. Phyto Chemicals and Herbal Products	3	-	3	30	70	3
5	16BT E34 16BT E35 16BT E36	**Elective – IV** 1. Developmental Biology 2. Pharamceutical Biotechnology 3. Bioprocess Economics & Plant Design	3	-	3	30	70	3
PRACTICALS								
7	16BT C37	Bioprocess Lab	-	3	3	25	50	2
8	16BT C38	Mass Transfer Operations Lab	-	3	3	25	50	2
9	16BT C39	Bioinformatics Lab	-	3	3	25	50	2
10	16BT C40	Mini Project	-	1	1	50	-	1
TOTAL			**18**	**10**	**28**	**225**	**500**	**25**

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

16BT C29

FERMENTATION TECHNOLOGY

Instruction	4L Periods per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Sessionals	30 Marks
Credits	4

Course Objectives:

1. The course aims at providing knowledge to students on scope and chronological development of fermentation technology.
2. To understand the types of fermentation process and design of fermentation.
3. To learn about the ancillaries of fermentor and its applications.
4. To gain in-depth knowledge about the working principles and operation of fermentors.

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

1. Interpret the Fermentation process.
2. Explain the types of fermentation media design and development of inocula.
3. Hypothesize the control of fermentation by various physical and chemical process parameters.
4. Summarize the scale up of fermentors and working principles.
5. To know the Differentiation between various fermentation systems.
6. Evaluate rheological properties of fermented broths.

UNIT-I INTRODUCTION TO FERMENTATION PROCESSES

The range of fermentation processes; Industrial applications; Future trends in fermentations; General requirements of fermentation processes, Basic design and construction of fermentor and ancillaries, Main parameters to be monitored and controlled in fermentation processes.

UNIT- II MEDIA DESIGN AND DEVELOPMENT OF INOCULA

Typical media, Media formulation, energy resources, carbon and nitrogen components. Solid-substrate, Submerged fermentation and its applications. Development of Inocula – For yeast and Mycelial Process, The aseptic inoculation of plant fermenters.

UNIT- III AERATION AND AGITATION IN FERMENTATIONS

Oxygen transfer from gas bubble to cells; Oxygen transfer in fermentations; Oxygen transfer in large vessels: Bubble aeration and Mechanical agitation; Correlations for mass transfer coefficients; Gas Hold up; Measurement of K_La- Oxygen-Balance method, Dynamic Method, Sulphite Oxidation

UNIT- IV SCALE UP AND RHEOLOGY IN FERMENTATIONS

Scale up of fermentation processes; Principles, theoretical considerations and techniques used; Scale down methods; The Rheology of fermentation broths; Rheological models; Measurement of rheological parameters; Rheological Control of fermentations; Mixing concepts, power requirement for mixing and improvement of mixing in fermentations.

UNIT - V FERMENTORS

Batch, Fed-batch and Continuous Fermentation systems; Dual and multiple fermentations; Comparison between batch and continuous fermentations; Steady state, unsteady state continuous fermentation theories; Examples of continuous fermentation; Practical problems with continuous operations. Behavior of microbes in different reactors (air lift, fluidized, batch, and continuous fed batch condition).

Text books:

1. Stanbury PF, Whitaker A and Hall S J, "Principles of Fermentation Technology" 2nd edition, Elsevier, 2013,
2. Pauline M. Doran, "Bioprocess Engineering Principles", Academic press, 1995

Suggested Reading:

1. Brian McNeil and Linda Harvey, " Practical Fermentation Technology" Wiley, 2008.
2. Crueger W and Crueger A, "Biotechnology: A Text Book of Industrial Microbiology", 2nd Edition, Panima Publishing Corporation, New Delhi, 2000.

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16BT C30

MASS TRANSFER OPERATIONS

Instruction	4L Periods per week
Duration of End Examination	4 Hours
Semester End Examination	70 Marks
Sessionals	30 Marks
Credits	4

Course Objectives:

1. To provide the students with knowledge about various unit operations such as absorption, distillation, extraction, leaching.
2. To give insight about various membrane separation processes such as adsorption, Ion-exchange, dialysis and the application of these unit operations in commercial aspects of biotechnology.

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

1. Molecular diffusion in solids, liquids and gases
2. Determine the number of trays needed for the separation
3. Carry out material balances accurately.
4. Explain the principles of the various separation processes involved in the downstream processing of products, especially those of biological origin
5. Explain the principles and application of membrane separation processes.
6. Understand the types of adsorbents.

UNIT- I PRINCIPLES OF MASS TRANSFER

Introduction to Mass transfer and Diffusion, Molecular diffusion in Gases, Molecular diffusion in Liquids, Molecular diffusion in Biological solutions and gels, Molecular diffusion in Solids, Inter phase mass transfer and Mass transfer coefficients.

Gas - Liquid operations: Equilibrium relations between phases, Mass transfer between phases, Choice of solvent for absorption, Single stage and multi stage co current and counter current operations, Estimation of Mass transfer coefficient, Calculation of HTU, NTU concepts, equipments mechanically agitated vessels, packed columns and plate columns.

UNIT- II PRINCIPLES OF VLE FOR BINARY SYSTEM

Phase rule and Raoult's law, Boiling point diagrams and x-y plots, Relative volatility, Flash distillation, Differential distillation, Simple steam distillation. Distillation with reflux and McCabe - Thiele method. Special Cases for rectification using McCabe - Thiele; Stripping column distillation, Enriching Column distillation, Rectification with direct steam injection, Rectification with single side stream.

UNIT- III LIQUID - LIQUID EXTRACTION AND LEACHING

Introduction to Extraction process: Equilibrium relations in extraction, Analytical and graphical solutions for single and multi stage operations co-current and counter current operations without reflux. Equipments for liquid-liquid extraction: mixer-settlers for extraction, Plate and Agitated Tower Contactors for Extraction, Packed and spray Extraction towers.

Introduction to leaching process: Equilibrium diagrams for leaching, analytical and graphical solutions for single and multi stage counter current operations.

UNIT - IV BASIC CONCEPTS IN DRYING OF PROCESS MATERIALS

Methods of drying, Equipment for drying; Free moisture content of materials; Concept of bound and unbound moisture content of biological materials; Rate of drying curves; Calculation methods for constant-rate & falling rate drying methods; Freeze drying of biological materials.

UNIT- V ADSORPTION AND MEMBRANE SEPARATION PROCESS

Theory of adsorption, Industrial adsorbents, Adsorption equilibria, Frendlich equation-single and multiple operations- processing variables and adsorption cycles Introduction and Types of Membrane separation process: Principles of ion exchange. Dialysis, Gas permeation membrane processes, types of membranes and permeability's for separation of gases, Introduction to types of flow in gas permeation.

Text Books:

1. C J Geankopolis, "Transport Processes in chemical Operations", 4th edition, Prentice Hall India.
2. Robert ETreybal, "Mass Transfer operations", 3rd edition. McGraw-Hill.
3. Warren L, McCabe, Julian C. Smith, Peter Harriot, "Unit operations of Chemical Engineering", 5th Edition, McGraw- Hill.

Suggested Reading:

1. Jaime Benitez, "Principles and Modern Applications of Mass Transfer Operations", 2nd edition, 2009
2. J M Coulson and J F Richardson, "Chemical Engineering", Vol-II, 3rd edition, Pergamom Press.

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16BT C31

BIOINFORMATICS

Instruction	4L Periods per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Sessionals	30 Marks
Credits	4

Course Objectives

1. To provide elementary knowledge in bioinformatics and biological information available to biologist on the web and learn how to use these resources on their own.
2. To learn fundamentals of biological databases and sequence alignment.
3. To understand evolutionary relationship among organisms.
4. To learn methods for determining the order of the nucleotide and to predict gene.
5. To aid in understanding structural bioinformatics and biochemical databases.

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

1. Explain the basics of bioinformatics and its scope.
2. Identify how biological databases are used for the retrieval of information.
3. Demonstrate the methods of sequence alignment and its use.
4. Create an evolutionary tree, evaluate and different software tools used for phylogenetic analysis.
5. Discuss about genome sequencing and genome sequencing projects.
6. Predict gene and protein structure and explain about biochemical databases.

UNIT-I INTRODUCTION TO BIOINFORMATICS AND BIOLOGICAL DATABASES

Need of Computers in Biotechnology Research, Elementary commands and protocols, ftp, telnet, http; Bioinformatics- Introduction, Scope of Bioinformatics, Applications; Introduction to biological databases, types of biological database, file formats for biological sequence (NCBI, EMBL, SWISSPROT, FASTA); Information retrieval from biological Databases.

UNIT- II SEQUENCE ALIGNMENTS

Sequence Alignment-Local, Global alignment; Methods of pairwise sequence alignment; Multiple Sequence alignment methods; Comparison of pair wise and multiple alignment; Sequence database search- FASTA, BLAST, various versions of BLAST and FASTA; Amino acid substitution matrices- PAM and BLOSUM.

UNIT- III PHYLOGENETIC ANALYSIS

Understanding Evolutionary process; Origin of Molecular Phylogenetics; Relationship of phylogenetic Analysis to sequence alignment; Concept of evolutionary trees; Methods of Phylogenetic analysis, Tree Evaluation, Problems in Phylogenetic Analysis, Automated Tools for Phylogenetic Analysis.

UNIT-IV GENOME MAPPING AND GENE PREDICTION

DNA sequencing- Map assembly, Genome Mapping; Genome sequencing, cDNA sequencing, Genome sequence assembly, Comparative Sequence Analysis; Gene Annotation; Human Genome Project (HGP); Basis of Gene Prediction, Gene predictions in Microbial genomes and eukaryotes, Gene Prediction Methods, Other Gene Prediction Tools.

UNIT -V STRUCTURAL BIOINFORMATICS AND BIOCHEMICAL DATA BASES

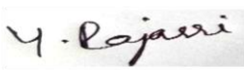
Protein structure basics, protein structure classification, visualization and comparison, protein secondary structure prediction and protein tertiary structure prediction; Introduction to Biochemical databases- KEGG, BRENDA. Molecular Modeling Databases (MMDB).

Text books:

1. David Mount, "Bioinformatics Sequence and Genome Analysis", 2nd edition, CBS Publishers and Distributors Pvt. Ltd., 2005
2. Rastogi SC, Mendiratta N and Rastogi P, "Bioinformatics: Methods and Applications Genomics, Proteomics and Drug discovery", 3rd edition, PHI Learning Private Limited, New Delhi, 2010.

Suggested Reading:

1. Baxebanis AD and Francis Ouellette BF, "Bioinformatics a practical guide the analysis of genes and proteins", 2nd edition, John Wiley and Sons, Inc., Publication, 2001.
2. Vittal R Srinivas, "Bioinformatics: A modern approach. PHI Learning Private Limited", New Delhi, 2009.
3. Ji Xiong, "Essential Bioinfomatics", Cambridge End Press, 2006.



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18CS E02

JAVA Programming and Bio-Java

(Elective-III)

Instruction	4L Periods per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Sessionals	30 Marks
Credits	4

Course Objectives: The main objective of this course is:

1. To introduce the concepts of Object-Oriented programming.
2. Prepare the students to develop solutions using OOPs concepts.
3. Identify Java class libraries and Bio-Java class libraries.
4. Understand and develop GUI based solutions.
5. Develop Biotechnology related solutions using Java and Java class libraries.

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

1. Understand fundamental concepts in object-oriented programming.
2. Design and develop computer based solutions to solve real world problems.
3. Handle file I/O and exceptions.
4. Create Windows, Containers, GUI components in Java.
5. Create GUI-based applications.
6. Develop programs related to Biotechnology problems.

UNIT-I

Java Essentials: Features of Java, OOPs concepts in Java, Elements of java program, Variables, and Literals, Data Types, variables and arrays, Operators, arrays
Control structures: if, if-else, nested if, if-else-if, switch, while, do-while, for, break and continue statements.

UNIT-II

Classes and Objects: Introduction to classes and methods, typecasting, access specifiers and modifiers, modifiers, passing arguments, Constructors.
Inheritance: Basics of inheritance, types of inheritance, polymorphism.

UNIT-III

Interfaces and Packages: Basics of interfaces, Packages, **Exception handling**: Types of exceptions and Errors, exception handling, Multithreading concepts.
Files and I/O Streams: File Class, Streams, Byte Streams.

UNIT-IV

AWT and Applets: Applets, GUI, Window class hierarchy, Dialog Boxes,, Layout managers, Swing Component Classes, Event-Handling, AWT Graphics classes and Swing Controls.

UNIT-V

StrBioLib: Molecular Biology Classes, Interfaces to Bioinformatics tools and Databases,General purpose tools, applications.

Writing simple Java programs for Biotechnology related problems.

Text Books:

1. Sagayaraj, Denis, KArthik and Gajalaxmi, "Java Programming", for Core and Adanced Learners", University Press, Pvt. Ltd, 2018.
2. Johan-Marc Chandonia, **StrBioLib**: a Java Library for Development of Custom Computations Structural Biology Applications", BIO-INFO ALPPLICATIONS NOTE, Vol. 23, No. 15,2007, PP2018-2020 (https://academic.oup.com/bioinformatics/article-abstract/23/15/2018/203542)

Suggested Reading:

1. https://www.tutorialspoint.com/java/index.htm
2. Herbert Schildt, " The complete reference Java 2", TMH
3. Internet World 60 minute Java by Ed Tittel

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16BT E32

MEDICAL BIOTECHNOLOGY

(Elective-III)

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

Course Objectives

1. To understand the scope and importance of tools used in medical biotechnology.
2. The course aims at providing knowledge about the working principles and types of advanced materials used in medical field.
3. To gain the in-depth knowledge about the clinical applications of stems cells &banking
4. To understand the differences between the normal cells and cancer cells and various diagnostic methods used in cancer detection.
5. To learn current molecular therapies and controversial issues..
6. To understand the bioethical issues.

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

1. Use the tools for the diagnosis of diseases.
2. Be in a position to design the prototype of medical instruments.
3. Explain the potentiality of stem cells and purpose of banking.
4. Explain about the uses of molecular therapies and how which led to controversy in society.
5. Explain about the advances in vaccines in production.
6. Analyze the socio ethical issues in medicine.

UNIT - I : INTRODUCTION TO MEDICAL BIOTECHNOLOGY

Introduction, scope and importance of medical biotechnology; The genetic basis of the disease; chromosomal disorders; single gene disorders-modes of inheritance, Thalassemia, sickle cell anaemia, cystic fibrosis, Tay sachs disease, Fragile –X-syndrome; polygenetic disorders; Alzheimers disease,Type-1diabetis and mitochondrial disorders (neurological disorders).

UNIT- II MEDICAL ONCOLOGY

Cancer types (case study: breast cancer and stomach cancer); Normal cells vs. cancer cells; cancer genetics; oncogenes and their proteins; tumor suppressor genes and their functions, diagnosis of cancer, Treatment of cancer; Radiation therapy, chemotherapy.

UNIT- III STEM CELL TREATEMENT

Cellular therapy, stem cells- definition, types, properties and uses of stem cells; sources of embryonic and adult stem cells; concept of tissue engineering; scaffolds and fabrication; clinical applications of stem cells; stem cell banking and ethical issues.

UNIT - IV MEDICAL INSTRUMENTATION AND DIAGNOSTICS

Concepts in Biomedical Engineering; principle, properties and applications of different types of biomedical devices; pacemakers, drug coated stents, dental implants, knee replacement implants, Molecular diagnosis by immunological approaches to detect protein biomarkers of the disease (types of ELISA), DNA approaches (Taq MAN approach, RT-PCR, epigenetic markers, detection of SNP by mass spectrometry; Applications of biosensors in medicine.

UNIT - V MOLECULAR THERAPEUTICS AND BIOETHICAL ISSUES

Types of molecular therapies; protein therapy by recombinant MAB, Enzymes (DNase-1, Alpha -1 antitrypsin), Lactic acid bacteria by Leptin, antisense therapy, immunotherapy by immunotoxins and recombinant vaccines.Bioethical issues in IVF, surrogacy and cloning technologies.

Text Books:

1. Judith Pongracz, Mary Keen, "Medical Biotechnology", illustrated edition, Elseiver health sciences, 2009.
2. Bernard R Glick, Cheryl L.Patton, Terry L.Delovitch, "Medical biotechnology", 1st edition, ASM press,2013.
3. Cato T.Laurencin, MD.Ph.D, Lakshmi S-Nair, M.Phil.,Ph.D "Nano Technology and Regenerative Engineering The Scaffold", Second Edition, CRC Press, Taylor & Francis Group, 2014.

Suggested Reading:

1. R.J.B.King, Robins, "Cancer biology", 3rd edition, Prentice Hall, 2006.
2. Subdery, "Human Molecular Genetics", 2nd edition, Prentice Hall, Pearson education.

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16BT E33

PHYTO CHEMICALS AND HERBAL PRODUCTS

(Elective-III)

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

Course objectives:

1. To impart knowledge on medicinal plants and extraction of crude drugs.
2. To provide a comprehensive knowledge on analysis, types and detection of phytochemicals and adulterants.
3. To impart knowledge on the applications of various phytochemicals and herbal products.

Course outcomes: At the end of the course the students are able to

1. The undergraduates will know the sources of various crude drugs and their medicinal values.
2. The students will understand the procedures involved in the detection, extraction and analysis of crude drugs and adulterants.
3. The undergraduates will be able to implement their theoretical concepts and knowledge of extraction and their applications in herbal preparation for implementing the same practically.
4. Understand the preparation of adulterants.
5. Apply the different types of phyto chemicals in the real world.
6. Recognize the applications of herbal products.

UNIT I: CRUDE DRUGS, MEDICINAL AND AROMATIC PLANTS

Crude Drugs - Scope and Importance, Classification (Taxonomical, Morphological Chemical, Pharmacological); Collection and processing of Crude Drugs. Utilization of Medicinal and Aromatic Plants in India. Genetics as applied to Medicinal herbs. Biogenesis of Phytopharmaceuticals.

UNIT II: ANALYSIS OF PHYTOCHEMICALS

Methods of Drug evaluation (Morphological, Microscopic, Physical and Chemical). Preliminary screening, Assay of Drugs - Biological evaluation / assays, Microbiological methods, Chemical Methods of Analysis and Detection of Adulterants: Chemical estimations. Drug adulteration - Types of adulterants.

UNIT III : TYPES OF PHYTOCHEMICALS

Carbohydrates and its derived products- Structures, types and extraction methods : Glycosides - Digitalis, Aloe, Dioscorea ; Volatile Oils - Clove, Mentha; Alkaloids - Taxus, Papaver, Cinchona; Flavonoids-and Resins. Tannins (Hydrolysable and Condensed types).

UNIT IV: APPLICATIONS OF PHYTOCHEMICALS

Application of phytochemicals in industry and healthcare; Biocides, Bio-fungicides, Biopesticides (Bacterial, fungal, viral with examples).

UNIT V: HERBAL PRODUCTS

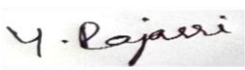
History, Scope, and Current aspects of herbs and herbal medicines; Classification of active components of therapeutic plant and herbal products; Preparation of standardized extracts of Garcinea, Forskolin, Garlic, Turmeric and Capsicum, issues of licencing of herbal drugs.

Text books:

1. Kokate CK, Purohit AP and Gokhale SB, "Pharmacognosy", 4th edition, Nirali Prakashan, 1996.
2. Trease and Evans WC Evans, " Pharmacognosy" , 14th edition, Harcourt Brace & Company. 1989.
3. Hornok L, "Cultivation & Processing of Medicinal Plants" Chichister, U. K: J. Wiley & Sons.1992.

Suggested Reading:

1. Natural Products in medicine: A Biosynthetic approach Wiley. 1997
2. Chaudhri RD, "Herbal Drugs industry, A practical approach to Industrial Pharmacognosy" Eastern publishers, 2nd reprint, New Delhi. 1999.



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16BT E34

DEVELOPMENTAL BIOLOGY
(Elective-IV)

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

Course Objectives:

1. Students are made to understand the basic concepts of developmental biology.
2. Students are taught the structure of gametes, and how they are generated.
3. Students are taught the influence of genes on body axis formation in Drosophila and Mammals.
4. Students are enlightened about the later embryonic developments i.e Organogenesis.
5. Students are made aware of sex determination in Drosophila and Mammals.
6. The concept of Ramifications of developmental biology is introduced to the students.

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

1. Students understand the basic concepts of Developmental Biology.
2. Students understand the Anatomy of gametes and Biochemistry in its recognition.
3. Analyze the role of genes in the body axis formation of Drosophila and Mammals.
4. Understand the importance and differentiation of germinal layers in to different organs.
5. Compare the role of genes in the sex determination of Drosophila and Mammals.
6. Explain the genetic anomalies leads to diseases.

UNIT-I: INTRODUCTION TO DEVELOPMENTAL BIOLOGY

The Anatomical approach to developmental biology: Mathematical modeling for development: The frog life cycle: Evidence for Genomic equivalence (Potency of cells), Specification (Autonomous, Conditional and Morphogenic Gradients: Commitment, Induction (Paracrine Factors) and Competence.

UNIT-II : EARLY EMBRYONIC DEVELOPMENT (Gametogenesis and Fertilization)

Structure of Gametes, Spermatogenesis and oogenesis in Mammals, Recognition of egg and sperm: Mammalian Fertilization (Fusion of Gametes and prevention of Polyspermy), External Fertilization in Sea urchin.

UNIT-III: LATER EMBRYONIC DEVELOPMENT (Morphogenesis)

Cleavage and gastrulation in Drosophila and Mammals: Early Drosophila developments: Genes that pattern the

Drosophila body axis: The generation of dorsal, ventral polarity: The origin of anterior, Posterior polarity: Segmentation genes (Gap Genes, pair rule genes and segment polarity genes), The homeotic selector genes: The anterior and posterior axis formation in Mammals.

UNIT-IV: ORGANOGENESIS AND SEX DETERMINATION

The emergence of Ectoderm-The Central nervous system and epidermis development: the function of mesoderm –osteogenesis and myogenesis: Lateral plate mesoderm and endoderm – the development of heart, blood cells, digestive and respiratory systems, Sex determination in Drosophila and Mammals: regeneration of liver in Mammals.

UNIT-V : RAMIFICATIONS OF DEVELOPMENTAL BIOLOGY

Medical Implications of Developmental biology, genetic errors of human development, infertility, *in vitro* fertilization (IVF) and teratogenesis (disruptors of teratogenesis): Developmental biology and future of medicine.

Text Books:

1. Manju Yadav, “Molecular Developmental Biology” Discovery Publishing, September, 2008.
2. Scott F Gilbert, Michael JF Barresi. “Developmental Biology”, 10th edition, Sinauer Associates, Inc, 2013.

Suggested Reading:

1. Snustad P, Simmons and Jenkins, “Principles of Genetics”, 2nd Edition, John Wiley Publications, 1999.
2. P.C.Jain , “Elements of Developmental Biology” International Publications, 2013.

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16BT E35

PHARMACEUTICAL BIOTECHNOLOGY

(Elective-IV)

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

Course Objectives:

Students are made to analyze the following concepts during there course of time:

1. Origin, Scope and importance of pharmaceutical biotechnology.
2. ADME of Drugs. Pharmacokinetics and Pharmacodynamics of drugs.
3. Materials and Formulations of pharmaceuticals.
4. Collection, processing and storage of whole human blood.
5. Ideal requirements of Polyvinyl Pyrollidine and Dextran 40.
6. Steroidal and Nonsteroidal drugs, Antacids, Alkaloids and Biological extracts.

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

1. Identify different microorganisms for the production of secondary metabolites used as drugs.
2. Explain drug delivery systems like oral, parenteral, transdermal etc.
3. Outline the manufacture, Labeling, preservation and release of drugs in to the market.
4. Discuss fractionation of human RBC, dried human plasma, HPPF, from whole human blood.
5. Plan the procedures for the production of blood transfusion products to avoid infectious diseases.
6. Select the therapeutic activity and dosage of drugs to treat the diseases.

UNIT- I: FUNDAMENTALS OF BIOPHARMACEUTICALS

Pharmaceutical Biotechnology: An introduction, Origin, definition, Scope and Importance. Human protein replacements, Therapeutic agents for human diseases: Tissue Plasminogen activator, Interferon, Recombinant vaccines. Methods of Biotechnology and their applications of Gene transfer.

UNIT- II: DRUG METABOLISM AND PHARMACOKINETICS

ADME properties- Physiochemical properties of Drug Absorption, Distribution, metabolism (Biotransformation), bioavailability and Excretion. Pharmacokinetics and Pharmacodynamics. Basic considerations: Drug receptors, Drug interactions, Surgical supplies, Oral, Parenteral, Transdermal, Ophthalmic, Intravaginal and Intrauterine Drug Delivery systems.

UNIT- III: THE DRUG MANUFACTURING PRACTICES

Good manufacturing practices and facilities for drug production. Types of Tablets and capsules. Materials and Formulations for Manufacture of Tablets, Capsules. Excepients and its ideal properties, Parenteral solutions, Oral liquids, Emulsions, Ointments, Suppositories, Aerosols.

UNIT-IV: BLOOD AND PLASMA SUBSTITUTES

Collection, processing and storage of whole human blood, concentrated human RBC, dried human plasma, Human plasma protein fraction, Dried human serum, Human fibrinogen, Human thrombin, Human normal Immunoglobulin, Plasma substitutes- Ideal requirements, PVP, Dextran 40, control of Blood products, Transfusion products.

UNIT-V: PHARMACEUTICAL PRODUCTS

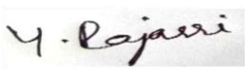
Fundamentals of Therapeutic categories such as Analgesics, Antipyretic, Anti-inflammatory drugs, Anesthetics, Antacids, Alkaloids, Glycosides, Anti-neoclassic drugs, Biologicals (Immunizing agents and allergenic extracts), Chemotherapy of Tuberculosis and Urinary tract infections.

Text books:

1. Purohit SS, Kakrani HN and Saluja AK., “Pharmaceutical Biotechnology”, Student Edition Jodhpur, 2003.
2. Brahmankar, D.M., Sunil, B.Jaiswals - Biopharmaceutics & Pharmacokinetics a Treatise , 2nd edition, M.K.Jain Publication, Delhi, 2009.
3. Cooper and Guns, “Pharmaceutics”, CBS publishers, 1989.

Suggested Reading:

1. David B Troy and Paul Beringer, “Remington’s: The Science and practice of Pharmacy”, Vol 1 and 2, Lippincott Williams & Wilkins Publications, 2006.
2. Tripathi, K.D. “Essentials of Medical pharmacology”, Jaypee Brothers Medical Publishers 6th Edition , John Wiley, New Delhi, 2000.
3. Milo Gibaldi - Biopharmaceutics and Clinical Pharmocokinetics, First edition, Pharma Book Syndicate, 2006.



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16BT E36

BIOPROCESS ECONOMICS & PLANT DESIGN

(Elective-IV)

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

Course Objectives:

1. To provide the students with knowledge about basic concepts in Interest, capital investment tax and depreciation;
2. Measures of economic performance.
3. This course aims at providing an insight into capital, overhead and manufacturing costs estimation
4. The course is designed to give an understanding of process design development and general design considerations.
5. This course aims at providing knowledge on design of batch and continuous sterilizers**,** Design calculations for immobilized enzyme kinetics.
6. To give insight about various types of valves, pumps, steam traps, spargers and impellers used in biotech industries.

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

1. Carry out interest calculations and prepare balance sheets for business transactions.
2. Determine the economic analysis of bioprocesses.
3. Carry out cost estimations for different industrial productions.
4. Develop process design, flow diagrams.
5. Carry out material and energy balances accurately
6. Design filters for air sterilization, batch and continuous sterilizers, valves etc.

UNIT-I: ECONOMIC EVALUATION

Capital cost of a project; Interest calculations, nominal and effective interest rates; basic concepts in tax and depreciation; Measures of economic performance, rate of return, payout time; Cash flow diagrams; Cost accounting-balance sheet and profit loss account; Break even and minimum cost analysis.

UNIT- II : BIOPROCESS ECONOMICS

Bio-Products regulations; Economic analysis of bioprocess; Capital, overhead and manufacturing costs estimation; Case studies of antibiotics (Penicillin and Streptomycin), recombinant products, single cell protein, anaerobic processes and other fine chemicals.

UNIT- III : INTRODUCTION TO PLANT DESIGN

Process design development: design procedures, design information and flow diagrams, material and energy balances, comparison of different process and design specifications; Optimization; General design considerations: Health and safety hazards, Environment protection, plant location and plant layout, plant operation and control.

UNIT- IV : BASIC DESIGN PROBLEMS

Design examples on continuous fermentation, aeration, and agitation; Design calculation of filter for air sterilization; Design of batch and continuous sterilizers; Design calculations for immobilized enzyme kinetics; Practical considerations in designing of Bioreactor/Fermentor construction.

UNIT- V :

Introduction to different types of valves, pumps, steam traps, spargers and impellers used in fermentation industries; Design exercise on trickle flow fermentor; Problems associated with design equations.

Text Books:

1. Plant Design and Economics for Chemical Engineers, 5/e Max S. Peters, Ronald E. West, (2003) McGraw-Hill Higher.
2. Biochemical Engineering -Humphrey, A. E.; Millis, JSTOR 1966.
3. Biochemical Engineering, by Harvey W. Blanch, Douglas S. Clark CRC; 1st edition (1997).

Suggested Reading:

1. Biochemical Engineering and Biotechnology Handbook by Bernard Atkinson, Ferda MavitunaGrove's Dictionaries; 2 edition (1992).
2. Bioprocess Engineering:Basic Concepts. Michael L. Shuler / Fikret Kargi, Reihe:Prentice ,(2001) Hall.

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16BT C37

BIOPROCESS LAB

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

Course Objectives

1. The course aims at providing knowledge about the methods of sterilization of cells and Thermal death kinetics of spores.
2. The course aims at demonstrating the design of the bioreactor.
3. The students understand the types of reactors and its instrumentation.
4. To analyze and compare fermentation kinetics.
5. To demonstrate the immobilized enzyme stability.

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

1. Out line the sterilization techniques.
2. Discuss about bioreactor instrumentation and control.
3. Compare the parameters to find optimum value where the microbial activity is higher.
4. To predict the K_La value.
5. Analyze the stability of immobilized enzyme.
6. Evaluate the flow characteristics of fluids.

LIST OF EXPERIMENTS

1. Sterilization techniques (chemical, physical and filter methods) and thermal death kinetics.
2. Media optimization (placket- Burman design)
3. Bioreactor instrumentation and its control.
4. Microbial production of fine chemicals (Eg: citric acid and alcohol).
5. Study of growth substrate utilization.
6. Product formation kinetics in shake flask cultures.
7. Batch fermentation kinetics.
8. Fed batch fermentation kinetics.

9. Measurement of K_La by sodium sulphite (Na_2SO_3) oxidation method.
10. Studies on immobilized enzyme/cells in packed bed reactor.
11. Estimation of rheological parameters in fermentation broths.

Suggested Reading:

1. Gunasekharan P, Laboratory manual in Microbiology, 2009
Chellapandi P, Laboratory manual in Industrial Biotechnology, Pointer publishers, 2007

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16BT C38

MASS TRANSFER OPERATIONS LAB

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

Course Objectives:

1. This lab course is designed to understand and study the behavior of different reactors. Eg: Batch, CSTR, PFR, analysis of various processes viz., Diffusion, Distillation VLE.

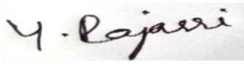
Course Outcomes: At the end of the course the students are able to

1. Determine the diffusion coefficient of liquids in air.
2. Verify the Rayleigh equation.
3. Calculate the theoretical and actual steam consumption.
4. Construct T-x-y diagram using VLE.
5. Determine equilibrium constant using Batch, CSTR and PFR reactors.
6. Calculate activation energy.

LIST OF EXPERIMENTS

1. Diffusion of CCL_4 organic vapor in air estimation.
2. Determine Liquid - liquid diffusivity.
3. Estimate Surface evaporation.
4. Wetted wall column.
5. To verify Rayleigh equation using Simple distillation.
6. Calculate the theoretical and actual steam consumption by Steam distillation.
7. To determine Packed bed distillation.
8. To determine Liquid - liquid equilibrium
9. To determine Liquid - liquid extraction.
10. To construct T-x-y diagram using Vapor liquid equilibrium
11. To determine equilibrium constant using Batch reactor.
12. To determine equilibrium constant using Continuous stirred tank reactor

13. To determine equilibrium constant using Saponification in a tubular reactor.
14. Mixed flow reactors in series.
15. To calculate the activation energy by Temperature dependency.



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16BT C39

BIOINFORMATICS LAB

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

Course Objectives:

1. To provide practical instructions to the students on using the specific databases and learn how to use these resources on their own and analysis the output.

Course Outcomes:

1. Retrieve the information from biological databases.
2. Utilize BLAST, FASTA and some online tools.
3. Use and compare the online sequence alignment tools.
4. Construction evolutionary tree by phylogenetic analysis.
5. Predict gene and protein structure.
6. Design primers and construct restriction map.

LIST OF EXPERIMENTS

1. Searching Bibliographic databases for relevant information.
2. Sequence retrieval from DNA and Protein databases.
3. BLAST services.
4. FASTA services.
5. Pair wise comparison of sequences (Local and global alignment).
6. Multiple Sequence Alignment.
7. Evolutionary studies/Phylogenetic Analysis.
8. Protein Databank retrieval and visualization.
9. Structure Exploration of Proteins.
10. Restriction Mapping.

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11. Identification of Genes in Genomes.
12. NCBI ORF Finder.
13. Primer Design.

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Suggested Reading:

1. Baxebanis AD and Francis Ouellette BF, “Bioinformatics a practical guide the analysis of genes and proteins”, 2nd edition, John Wiley and Sons, Inc., Publication, 2001.

16BT C40

MINI PROJECT

Instruction	1 P Periods per week
Duration of End Examination	1 Hours
CIE	50 Marks
Credits	1

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 50 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 50 Marks in the end examination:

1. Power point presentation	20 Marks
2. Thesis/Report preparation	30 Marks

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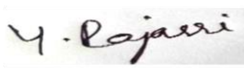

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY
B.Tech IV – Year

SEMESTER – I

THEORY						
S. No.	**Code**	**Subject**	**L**	**T**	**P**	**Credits**
1	BT 411	Downstream Processing	4	-	-	3
2	BT 412	Bioprocess Dynamics and Control	4	-	-	3
3	BT 413	Plant Biotechnology	4	-	-	3
4	BT 414	Animal Biotechnology	4	-	-	3
5	MB 216	Principles and Practice of Management	4	-	-	3
6		Elective – II	4	-	-	3
	BT 461	Developmental Biology				
	BT 462	Cancer Biology				
	BT 463	Genomics and Proteomics				
	BT 464	Pharmaceutical Biotechnology				
PRACTICALS						
7	BT 415	Downstream Processing Lab	-	-	3	2
8	BT 416	Tissue culture Lab	-	-	3	2
9	BT 417	Project Seminar	-	-	3	1
Total			**24**	**0**	**9**	**23**

L: Lecture, T: Tutorial, P: Practical

SEMESTER – II

THEORY						
S.no.	**Code**	**Subject**	**L**	**T**	**P**	**Credits**
1	BT 421	Computer Applications in Bioprocess Industries	4	-	-	3
2	BT 422	Bioprocess Economics and Plant Design	4	-	-	3
3		Elective – III	4	-	-	3
	BT 471	Molecular Modeling and Drug Design				
	BT 472	Immunodiagnostics				
	BT 473	Tissue Engineering				
4		Elective-IV	4	-	-	3
	BT 481	Bioprocess Validations and Current good manufacturing Practices				
	BT 482	Food Biotechnology				
	BT 483	Nanobiotechnology				
	ME 464	Entrepreneurship				
5	BT 423	Seminar	3	-	-	1
6	BT 901	Project	6	-	-	9
Total			**25**	**-**	**-**	**22**

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L: Lecture, T: Tutorial, P: Practical

DOWNSTREAM PROCESSING

BT 411

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

Course Objectives:

1. Student is made to understand the role and, importance of downstream processing.
2. Students are taught the various techniques of cell disruption and the principles of solid liquid separation processes, filtration and centrifugation
3. Students are made to understand the principles of membrane based separations and their applications.
4. Students are enlightened about chromatographic separations, types and their importance in product purification.
5. Students are made to study the principle of crystallization, drying and lyophilisation.
6. The students are made to understand the choice and sequence of bioseparations by case studies.

Course Outcomes:

1. Student will be able to know the key aspects of Downstream Processing from both a technical and economic perspective.
2. Be able to learn the various techniques of cell disruption and unit operations for separation of insolubles
3. Student will be able to design mineral water plant
4. Be able to design and select chromatographic separation process for different bioproducts and scale up
5. Be able to learn various techniques of product polishing and formulation.
6. Be able to analyze and summarize scientific results from real examples and use them to choose the best operational conditions for a particular unit operation.

UNIT- I: ROLE OF DOWNSTREAM PROCESSING IN BIOTECHNOLOGY

Role and Importance of Downstream Processing in Biotechnological Processes; Characterization of Biomolecules and fermentation broths; Physico-Chemical basis of Bio-separations; Characteristics of Bio-separations; Process design criteria for bioproducts; Downstream process economics.

UNIT- II: PRIMARY SEPARATION ANDRECOVERY PROCESSES

Cell Disruption methods for intracellular products- Mechanical, Chemical and Enzymatic Methods; Removal of Insolubles, Biomass separation techniques; Flocculation; Sedimentation; Centrifugation; Filtration: Theory, Equipment-Depth filters, Plate and frame filters, Pressure leaf filters, Continuous rotary drum filters, filter media and filter aids, Problems on specific resistance of the cake, time taken for filtration and, compressibility of cake.

UNIT- III: PRODUCT ENRICHMENT OPERATIONS

Membrane-based separations-Types of membranes, solution diffusion model, capillary flow model; Types of flow-Cross flow, Tangential flow and mixed flow; Types of membrane based separations: Micro-filtration, Ultra-filtration, Dialysis, Electro dialysis, Reverse Osmosis; Theory, design and configuration of membrane separation equipment, Applications; Aqueous Two-phase extraction of proteins; Precipitation of proteins with salts and organic solvents; Adsorption processes.

UNIT- IV: PRODUCT PURIFICATION AND POLISHING

Chromatographic separations- Principles, Classification, General description of column chromatography; IMAC, Bio-affinity Chromatography; Design and selection of chromatographic matrices; Design of large-scale chromatographic separation processes

UNIT- V: NEW AND EMERGING TECHNOLOGIES:

Pervaporation, super critical fluid extraction; Electrophoretic Separations; Final Product Polishing- Crystallization: nucleation, crystal growth, Industrial crystallizers, Drying: drying terminologies, drying curve, Industrial dryers Lyophilization: principles and applications; Formulation Strategies; Case studies (Citric acid / Penicillin and Low volume high value product like recombinant proteins).

Text Books:

1. Bio-separations: Principles And Techniques (2008)Prentice-hall Of India Pvt Ltd
2. Separation processes in Biotechnology by Sivasankar B,J M Asenjo, Marcel-Dekker, (1993).
3. Bio-separations- Downstream Processing for Biotechnology- Paul A Belter, E L Cussler, Wei-shouHu, Wiley Inter-science Publications, 1988.

4. Principles and Techniques of Practical Biochemistry by Keith Wilson, John Walker, John M. Walker 5^{th} edition Cambridge University Press, (2000).

Suggested Reading:

1. Product Recovery in Bioprocess Technology- BIOTOL series, Butterworth Heinmann, (1992).
2. Separations for Biotechnology- M S Verall, M J Hudson, Ellis Harwood Ltd. (1990).
3. Bio-separations Science and technology Roger Todd Rudge Petreides Process Biotechnology Fundamentals by SN Mukhopadhya, Wankat PC. Rate controlled separations, Elsevier, (1990).
4. Bioseparations by Belter PA and Cussler E., Wiley (1985).
5. Product Recovery in Bioprocess Technology, BIOTOL.' Series, VCH, (1990).
6. Separation processes in Biotechnology Asenjo J.M., (1993), Marcel Dekkere Inc.
7. Downstream Process Technology by Nooralabettu Krishna Prasad PHI publications.
8. Bioseparations by Siva Shankar PHI publications.

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BT 412 **BIOPROCESS DYNAMICS AND CONTROL**

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

Course Objectives:

1. The course aims at providing dynamics of system process, flow, level and temperature etc.
2. The course aims at incorporating with concepts of response of first order system for non interacting and interacting systems.
3. The course aims at providing knowledge the design of control system for open and close loop control.
4. The course aims at inculcating concepts of the control of pH of process and biochemical reactions.

Course Outcomes:

1. Students will use the knowledge of dynamics in the process control of level, temperature, flow etc in biotechnology industries.
2. Students will apply this expertise of first order system of non interacting and interacting system in biotech industries.
3. Students will incorporate the knowledge of open and close loop system for control of Bioreactors in biotechnology industries.
4. Students will adopt the skill set of fine tuning the process variable in biotech industries.
5. Students will exhibit the knowledge of control wall sizing in the design of control valve system in bioprocess units.
6. Students will apply the knowledge of controlling of pH of bioreactor in bioprocess industry for achieving good product conversions.

UNIT I: PROCESS DYNAMICS

Process variables, Dynamics of simple processes – Flow, level, Temperature, Pressure and Concentration; Transfer function – Properties, response of simple processes for Step, Impulse and Sinusoidal Forcing functions.

Concept of Time Constant, Linearization, Response of first order systems in series - Non-interacting and Interacting systems.

UNIT II: CONTROL ACTIONS AND CONTROLLERS

Controller and Control system – measuring and final control elements, Open and Closed loop control, Negative and Positive feedback control, Servo and Regulatory problems.

Ideal transfer functions –Control valve, Controllers, Proportional, Integral and derivative actions – P+I. P+D and P+I+D controls.

Block diagram- Development of block diagram, Description of system, reactor transfer function, effect of time delay Over all Transfer function for single loop system, overall transfer function for change in set point.

UNIT III: OPTIMUM CONTROLLER SETTINGS

Controller Tuning – Evaluation criteria with l/4th decay ratio, IAE. ISE, ITAE.

Tuning - process reaction curve method, Continuous cycling method, damped oscillation method. control of processes with a time delay.

UNIT IV: FINAL CONTROL ELEMENT

I/P Converter– pneumatic, electric and hydraulic actuators. Control valves – Construction, valve sizing, valve characteristics, valve positioner. Control of Globe, Butterfly and Diaphragm valves.

UNIT V: ADVANCED CONTROL STRATEGIES

Feed forward control, Ratio control, Cascade control.

Dynamics and Control of pH process and Biochemical reactor.

Text Books:

1. Sarkar PK, “Process Dynamics and Control”, PHI, 2013.
2. Seborg, Edgar, Mellichamp, Doyle, “Process Dynamics and Control”, 3rd edition John Weily and Sons, 2010
3. Harriott P, “Process control”, Tata McGraw-Hill publishing Co., New Delhi, Reprint 1991.

Suggested Reading:

1. Principles of Process Control by Patranabis D, 2nd ed., Tata McGraw-Hill publishing Co., New Delhi, Reprint 1997.
2. Automatic process control, Eckman D.P., Wiley Eastern Ltd., New Delhi, (1993).
3. Process Systems Analysis and Control, Donald R.Coughanowr, 2nd ed., McGraw Hill Inc., 1991.

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BT 413 **PLANT BIOTECHNOLOGY**

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

Course Objectives:

1. The students should be able to understand explicitly the basic concepts of Plant Tissue culture.
2. To understand the developmental pathways of callus induction and plant regeneration.
3. To understand the techniques for production of secondary metabolites in *in vitro* using plant cell and tissue culture
4. To understand the methods of gene transfer in plants for production of transgenics.
5. To understand the various strategies and sources of trangenes for crop improvement.

Course Outcomes:

1. Provides opportunity to understand the theoretical concepts behind establishment of *in vitro* techniques.
2. Enables student to understand the importance and applications of various in vitro techniques
3. The course enables to exploit plant tissues for production of biologics at commercial scale.
4. Helps to understand the transgenes utilized in the production of trangencis resistant to biotic, abiotic stress resistant and improved quality etc.
5. The course enables the students to understand the appropriate vectors and gene transfer methodology for production of transgenics
6. Course enables the student to overall get an insight in to the basic concept and advances in plant biotechnology field

UNIT I: INTRODUCTION TO PLANT TISSUE CULTURE

Introduction to cell and tissue culture: History, Totipotency, Cell Theory, Tissue culture media (composition, preparation); Initiation and maintenance of callus and cell suspension culture, Organogenesis and Embryogenesis and their applications.

UNIT II TISSUE CULTURE IN CROP IMPROVEMENT

Micropropagation for virus-free plants, Somaclonal variation, Haploids in plant breeding, Germplasm conservation (Cryopreservation). Protoplast isolation, culture and fusion: Somatic hybridization.

UNIT III MOLECULAR FARMING & INDUSTRIAL PRODUCTS

Application of Plant biotechnology for the production of quality oil, Industrial enzymes, Antigens, Edible vaccines. Production of secondary metabolites from plant cell cultures using Cell suspension cultures, Immobilized cell systems Precursor feeding (elicitation) and hairy roots. Bioreactor systems and models for mass cultivation of plant cells.

UNIT-IV PLANT GENETIC ENGINEERING –I TECHNIQUES

Agrobacterium mediated gene transfer and cloning; Types of plant vectors and their use in genetic manipulation; and their application. Direct gene transfer methods; chemical methods, electroporation, microinjection, particle bombardment. Transient gene expression.

UNIT-V PLANT GENETIC ENGINEERING –II PRODUCTIVITY PERFORMANCE

Transgenics in crop improvement: Biotic Stress resistance: Herbicide,Insect, Disease, virus etc., Abiotic stress tolerance: Drought, Temperature, Salt. Transgenics for improved nutrional quality, storage, longer shelf life.

Text Books:

1. Bhojwani SS and Razdan, Plant Tissue Culture Theory and Practice, Elsevier Science, 2004
2. Chawla HS, Introduction to Plant Biotechnology, 4th edition, Oxford and IBH publishers, (2002

Suggested Reading:

1. Surabh Bhatia, Kiran Sharma, Randhir Dahiya and, Tanmoy Bera, Modern applications of Plant Biotechnology in Pharmaceutical Sciences, Elsevier publication, Academic press, 2015

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BT 414 **ANIMAL BIOTECHNOLOGY**

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

Course Objectives:

1. The students are expected to understand the technical procedure involved to culture animal cells.
2. Students will learn various steps involved in the establishment of primary culture and their maintenance
3. Students will know about cell viability and cytotoxicity
4. Students are expected to know about stem cells and their applications
5. Students will describe embryo transfer, cloning and gene transfer methods for generation of transgenic animals and its applications
6. To know various application of animal cell culture in different fields

Course Outcomes:

1. The students will learn the animal cell culture requirements and procedure
2. Students are able to learn how to establish and maintain animal cell culture
3. Students will describe the procedure used to know the cell viability and cytotoxicity
4. Students are able to learn about stem cells and their applications
5. Students will know various methods for embryo transfer, cloning and generation of transgenic animals and their applications
6. Students will come to know various applications of animal biotechnology.

UNIT- I ANIMAL CELL TISSUE CULTURE

History and scope of animal cell tissue culture, advantages and disadvantages of tissue culture; laboratory facilities for animal tissue culture; aseptic techniques; the substrate on which cells grow; treatment of substrate surfaces; Feeder layers on substrates; Culture media for cells and tissues; Culture procedures; Tissue culture Slide, Flask and test tube cultures, Organ culture, Whole embryo culture.

UNIT- II PRIMARY CULTURE AND CELL LINES

Isolation of tissue, Disaggregation (Enzymatic and Mechanical) of tissue and Primary culture. Culture cells and evolution of cell lines. Maintenance of cultures- Cell lines, Cell separation, Cell synchronization; Cloning of cell lines. Cell transformation, Bioreactors for animal cell culture; Scaling-up of animal cell culture, large scale cultures in Biotechnology.

UNIT- III STEM CELLS, CELL VIABILITY AND TOXICITY

Stem cells, types of stem cells, embryonic stem cells and their applications; measurement of cell viability and cytotoxicity, Measurement of cell death; Senescence, Apoptosis, necrosis.

UNIT- IV EMBRYO TRANSFER, CLONING AND TRANSGENIC ANIMALS

Artificial insemination, *in vitro* fertilization and embryo transfer, nuclear transplantation; cloning of animals - Reproductive cloning, therapeutic cloning; Gene transfer or Transfection methods; targeted gene transfer; Transgenic animals- Mice, Sheep, Pig, Rabbit, Goat, Cow and fish.

UNIT - V APPLICATIONS OF ANIMAL BIOTECHNOLOGY

Application of animal cell culture; Mammalian cell products; viral vaccines produced from animal cell cultures. Three dimensional culture and tissue engineering, Somatic cell genetics.

Text Books:

1. Ian Freshney, "Culture of Animal Cells: A manual of basic technique and specialized applications" seventh edition, John Wiley and Sons, 2015
2. John Masters, " Animal Cell culture: A practical approach" OUP Oxford, 2000

Suggested Reading:

1. Gupta PK, "Biotechnology and Genomics" Rastogi Publications, 1st edition, 6th reprint, 2013
2. A.K. Srivastava, R.K. Singh, M.P. Yadav, "Animal Biotechnology" Oxford & IBH Publishing Co. Pvt. Ltd., 2005.
3. Ranga MM, "Animal Biotechnology", 3 reprint, Agrobios, India, 2010.

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MB 216 **PRINCIPLES AND PRACTICE OF MANAGEMENT**

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. Basic principles, concepts and functions of management in industry.
2. Key competencies and skills required for problem-solving and decision-making in managerial situations.
3. The different organizational designs and structures.
4. Materials, operations and marketing management.
5. The role and functions performed by HR managers.

Course Outcomes: At the end of the course, student will be able to apply the
1. Managerial skills for managing a Unit / Branch.
2. The different operations / functional areas to process industry as an organization.
3. Assess the situations in an organization by critical examination and provide better decisions.
4. Dynamics of business and sense to formulate the direction of change.
5. Purchasing objects and principles to material management
6. Concept of marketing management to a global scenario.

UNIT - I
Management definition, Administration Vs Management Principles and Functions of Management, levels of management - System and Contingency approach to management - steps in Planning - Decision making process - organization: Definition, Line, staff, functional and matrix type organization, span of control (Graicuna`s Formulae), Centralization Vs Decentralization.
UNIT - II
Communication - Process, Grapevine, Networks and Barriers of communication - Managerial grid, Theory of X, Y and Z; Job Enrichment Vs Job enlargement - Control process - Introduction to Personnel Management: Functions, staffing process, need for HRD, Training & Development (TWI Programme)
UNIT - III Measurement of Morale - Job Design -Industrial Relations: Human relation Vs Industrial relations, Trade Unionism, Industrial Unrest, Wage and Incentive concepts - Role of ILO - MIS in industry - Management of public enterprises.
UNIT - IV Introduction to Financial Management : Sources of Finance, Capital & its Structure (CFS & FFS) Financial statements, cost sheet - Introduction to Purchase & Material management Purchasing objects and principles,types of purchasing, Vendor selection, rating, evaluation & Development - Inventory control, ABC analysis, stores organization and pricing of issues - concept of Warehousing.
UNIT - V Production and marketing Management: Types of Production, Quality control (Tools used), PPC, Maintenance management - Marketing management ; Definition and concept of marketing, functions of marketing, market research, Types of markets, Sales Forecasting, Promotion mix - Pricing - Product Identification - A brief note on International Marketing.

Text Books:

1. Harold Koontz and Heinz Weihrich, "Essentials of Management-An International Perspective", 9th Ed., Tata McGraw-Hill Edu Pvt. Ltd, 2012.
2. Khan & Jain, "Financial Management", 7th Ed., Tata McGraw-Hill Edu Pvt. Ltd, 2014.

Suggested Readings:

1. David A. DeCenzo, David A, Robbins, Stephen P, "Fundamentals of Human Resource Management", 11th Ed, John Wiley and Sons Inc, 2015.
2. Elwood S Buffa, Rakesh K. Sarin, "Modern Production/Operations Management", 8th Ed, Wiley India Pvt. Ltd., 2007.
3. Jennifer George and Gareth Jones "Understanding and Managing Organizational Behavior", Published by Pearson Education Inc., 2013.
4. I. M. Pandey, "Financial Management", 10th Ed. Vikas Publishing House, 2013.
5. Gary Dessler, "Human Resources Management", 11th Eastern Economy Ed., 2011.

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Elective-II

DEVELOPMENTAL BIOLOGY

BT 461

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

Course Objectives:

1. Students are made to understand the basic concepts of developmental biology.
2. Students are taught the structure of gametes, and how they are generated.
3. Students are taught the influence of genes on body axis formation in Drosophila and Mammals.
4. Students are enlightened about the later embryonic developments i.e Organogenesis.
5. Students are made aware of sex determination in Drosophila and Mammals.
6. The concept of Ramifications of developmental biology is introduced to the students.

Course Outcomes:

1. Students understand the basic concepts of Developmental Biology.
2. Students understand the Anatomy of gametes and Biochemistry in its recognition.
3. Analyze the role of genes in the body axis formation of Drosophila and Mammals.
4. Understand the importance and differentiation of germinal layers in to different organs.
5. Compare the role of genes in the sex determination of Drosophila and Mammals.
6. Be able to explain the genetic anomalies leads to diseases.

UNIT-I INTRODUCTION TO DEVELOPMENTAL BIOLOGY

The Anatomical approach to developmental biology: Mathematical modeling for development: The frog life cycle: Evidence for Genomic equivalence (Potency of cells), Specification (Autonomous, Conditional and Morphogenic Gradients: Commitment, Induction (Paracrine Factors) and Competence.

UNIT-II EARLY EMBRYONIC DEVELOPMENT (Gametogenesis and Fertilization)

Structure of Gametes, Spermatogenesis and oogenesis in Mammals, Recognition of egg and sperm: Mammalian Fertilization (Fusion of Gametes and prevention of Polyspermy), External Fertilization in Sea urchin.

UNIT-III LATER EMBRYONIC DEVELOPMENT (Morphogenesis)

Cleavage and gastrulation in Drosophila and Mammals: Early Drosophila developments: Genes that pattern the Drosophila body axis: The generation of dorsal, ventral polarity: The origin of anterior, Posterior polarity: Segmentation genes (Gap Genes, pair rule genes and segment polarity genes), The homeotic selector genes: The anterior and posterior axis formation in Mammals.

UNIT-IV ORGANOGENESIS AND SEX DETERMINATION

The emergence of Ectoderm-The Central nervous system and epidermis development: the function of mesoderm – osteogenesis and myogenesis: Lateral plate mesoderm and endoderm – the development of heart, blood cells, digestive and respiratory systems, Sex determination in Drosophila and Mammals: regeneration of liver in Mammals.

UNIT-V RAMIFICATIONS OF DEVELOPMENTAL BIOLOGY

Medical Implications of Developmental biology, genetic errors of human development, infertility, *in vitro* fertilization (IVF) and teratogenesis (disruptors of teratogenesis): Developmental biology and future of medicine.

Text Books:

1. Jam PC, “Elements of Developmental Biology”, Vishal Publications, New Delhi, 1998.
2. Manju Yadav, “Molecular Developmental Biology” Discovery Publishing, September, 2008.
3. Scott F Gilbert, Michael JF Barresi. “Developmental Biology”, 10th edition, Sinauer Associates, Inc, 2013.

Suggested Reading:

1. Raven, P, “Developmental Physiology”, 1st edition, Pergamon Press, Newyork, 1959.
2. Snustad P, Simmons and Jenkins, “Principles of Genetics”, 2nd Edition, John Wiley Publications, 1999.
3. P.C.Jain , “Elements of Developmental Biology” International Publications, 2013.

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Elective-II
CANCER BIOLOGY

BT462

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

Course Objectives:
1. Student is made to understand the role of cell cycle and diet in cancer.
2. Students are taught the Molecular aspects of cell cycle control.
3. Importance of physical and chemical carcinogens taught by showing effects of mutagens on cell cycle.
4. Students are enlightened about discovery of proto-oncogenes and their activation.
5. Students are made to understand the diagnosis and treatment of cancer.
6. The concept of cancer pharmacology is introduced to the students.

Course Outcomes:
1. Apply to real life situations, the concept of diet and cell cycle.
2. Incorporate the fundamentals of cell biology and Molecular biology to under stand how they are responsible for cancer.
3. Be able to explain the types of carcinogens and the effect of mutagens on cell cycle.
4. Be able to describe the structure of retrovirus and how they led to discover the oncogens.
5. Be aware of no of stages of cancer, detection of cancer and treatment of cancer.
6. Be in a position to explain the ADME properties of anticancer drugs.

UNIT- I: FUNDAMENTALS OF CANCER BIOLOGY
Definition and hall marks of cancer, Cell cycle control, regulation of the cell cycle by cyclins, cyclin-dependent kinases, cdk inhibitors, Mutations that cause changes in signal molecules, Effects on receptor, Signal switches, Tumor suppressor genes, Different forms of cancer(Case studies for carcinoma ex: breast cancer and stomach cancer), Diet and cancer.

UNIT- II: PRINCIPLE S OF CARCINOGENESIS
Natural History of Carcinogenesis, Types of Carcinogenesis, Chemical Carcinogenesis, Metabolism of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, Ionizing radiation and UV radiation mechanism of Carcinogenesis.

UNIT- III: PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER
Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, Detection of Oncogenes, Growth factor and Growth factor receptors that are Oncogenes, Activation of protooncogens to oncogens. Growth factors related to transformations.

UNIT- IV: CANCER METASTASIS AND TREATEMENT
What is Metastasis, Classic theory of tumor Metastasis, Clinical significance of invasion, Heterogeneity of metastatic phenotype, Three-step theory of invasion (Basement Membrane disruption, role of Proteinases in tumor invasion and tumor cell locomotion).Diagnosis of cancers, Advances in Cancer detection(Biomarkers technology and nanotechnology), Different forms of therapy- Chemotherapy, Radiation therapy and immunotherapy.

UNIT- V:PRINCIPLES OF CANCER PHARMACOLOGY:
Pharmacokinetics and pharmacodynamics of antineoplastic drugs. Metabolism of anticancer drugs, inter individual differences in response to anticancer drugs, mechanisms of anticancer drug resistance. Molecular targets for drug development, mechanism of gene silencing (antisense, ribozymes, RNAi) and chemoprevention studies.

Text Books:

1. Franks LM and N.M.Teich , "Introduction to Cellular and Molecular Biology of Cancer", 2nd edition, Oxford Medical Publications, 1991.
2. Raymond W. Ruddon "Cancer Biology", 3rd edition, Oxford University Press, USA 1995.
3. King, Roger J B, Robins, Mike W, "Cancer Biology", 3rd edition, Prentice Hall, USA.2003.

Suggested Reading:

1. Fiona Macdonald, Christopher Ford, Alan Casson, "Molecular Biology of Cancer", 2nd Edition, Taylor & Francis, 2004.
2. Robert A. Weinberg, "The Biology of Cancer", 5th edition, Garland Science.2006.

3. Robin Hesketh, “Introduction to Cancer Biology” Cambridge University Publishers, Jan, 2013.

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Elective-II
GENOMICS AND PROTEOMICS

BT 463

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

Course Objectives:
1. Student is made to understand the fundamentals of genome
2. Students are taught about the transposable elements and their importance.
3. Students are made to understand DNA sequencing and various DNA sequencing methods.
4. Students are enlightened about construction and screening of cDNA libraries.
5. Students are made to understand the basics of proteomics, tools for proteomics and protein modifications
6. The concepts of metabolomics and pharamacogenomics are introduced to the students.

Course Outcomes:
1. Be able to know about genomes, types of genomes and the advanced techniques used for analysing genome.
2. Be able to explain the occurrence of genome variations due to the implication of transposable elements in the genome.
3. Be able to start self-employment from the knowledge obtained from various DNA sequencing methods.
4. Be able to construct cDNA libraries and explain the importance of cDNA libraries in the identification of functional genes in the genome
5. Be able to modify proteins for better use
6. Be able to design personalized medicines and explain their uptake, action and metabolism.

UNIT- I: STRUCTURAL GENOMICS
Overview of genome-Types, analysis of genomes; comparative homologies; evolutionary changes; Genetic analysis: Linkage mapping and analysis, High resolution chromosome maps, Physical mapping, YAC, BAC, Hybrid mapping strategies, microarrays, Sequence specific tags(SST),Sequence tagged sites(STS),FISH, RFLP and RAPD

UNIT- II: TRANSPOSABLE ELEMENTS
Transposable elements: General features of transposable element, Bacterial transposable elements: IS elements, composite transposons, Tn3 elements; Eukaryotic Transposable elements: AC/DC elements of corn, Ty elements of Yeast, P elements in drosophila, Human retro transposons; Transposition-mechanism; Implication of Transposable elements in the genome, Genome variation.

UNIT- III: FUNCTIONAL GENOMICS
Construction and screening of cDNA libraries; cDNA microarrays, Gene disruptions, Serial analysis of gene expression (SAGE), SAGE Adaptation for Downsized Extracts (SADE); Applications of DNA arrays

UNIT- IV: PROTEOMICS AND TOOLS USED FOR PROTEOMICS
Protein structure, Protein databases, data mining, Sequence alignment, Algorithms in proteomics, Applications of proteomics: proteome mining, protein expression profiling, protein-protein interactions, protein modifications; Protein digestion techniques; Mass spectrometry: MALDI-TOF, Mass analyzers, peptide Mass Fingerprinting, Protein arrays.

UNIT- V: METABOLOMICS AND PHARMACOGENOMICS
Metabolomis-Basics; Pharmacogenomics-Basics, Diseased genes and their identification; Drug uptake an metabolism; Drug targets; Designer medicine; Genomics perspective of bioterrorism; Ethical and legal implications.

Text Books:
1. Sahai S, “Genomics and Proteomics-Functional and Computational Aspects”, Plenum Publications, 1999.
2. Rastogi SC, Mendiratta N, Rastogi P, “Bioinformatics-Methods and Application, Genomics, Proteomics, and drug discovery”, 2nd edition, Prentice Hall of India, New Delhi, 2003.
3. Lieber DC, “Introduction to Proteomics, Tools for the new biology”, Humana Press, UK, 2000
4. Hunt SP, Levessy FJ, “Functional genomics” Oxford University Press, UK, 2000

Suggested Reading:
1. Proeomics in practice,A laboratorymanualof proteome analysis by JohnWiley-YCH,UK1999
2. ‘Genomics’by cantor, CR, Joohn Wiley, UK 1999

Elective-II

BT464 **PHARMACEUTICAL BIOTECHNOLOGY**

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

Course Objectives:

Students are made to understand the following concepts during there course of time:

1. Origin, Scope and importance of pharmaceutical biotechnology.
2. ADME of Drugs. Pharmacokinetics and Pharmacodynamics of drugs.
3. Materials and Formulations of pharmaceuticals.
4. Collection, processing and storage of whole human blood.
5. Ideal requirements of Poly vinyl Pyrollidine and Dextran 40.
6. Steroidal and Nonsteroidal drugs, Antacids, Alkaloids and Biological extracts.

Course Outcomes:

After completion of the course students gain knowledge in the following concepts:

1. Types of microorganisms for production of secondary metabolites used as drugs.
2. Types of drug delivery systems like oral, parenteral, transdermal etc
3. Types of excepients. Labelling, preservation and release of drugs in to the market.
4. Fractionation of human RBC, dried human plasma, HPPF, from whole human blood.
5. Control of blood transfusion products to avoid infectious diseases (HepatitisB, HIV)
6. Therapeutic activity and dosage of drugs to treat the diseases.

UNIT- I: FUNDAMENTALS OF BIOPHARMACEUTICALS

Pharmaceutical Biotechnology: An introduction, Origin, definition, Scope and Importance. Human protein replacements, Therapeutic agents for human diseases: Tissue Plasminogen activator, Interferon, Recombinant vaccines. Methods of Biotechnology and their applications of Gene transfer, Biotechnology production of Secondary Plant Metabolites.

UNIT- II: DRUG METABOLISM AND PHARMACOKINETICS

ADME properties- Mechanism and Physiochemical properties of Drug Absorption, Distribution, metabolism (Biotransformation) and Excretion. Pharmacokinetics and Pharmacodynamic Basic considerations. Drug interactions, Surgical supplies, Oral, Parenteral, Transdermal, Ophthalmic, Intravaginal and Intrauterine Drug Delivery systems.

UNIT- III: THE DRUG MANUFACTURING PRACTICES

Types of Tablets and capsules. Materials and Formulations for Manufacture of Tablets, Capsules. Excepients and its ideal properties, Parenteral solutions, Oral liquids, Emulsions, Ointments, Suppositories, Aerosols.

UNIT-IV: BLOOD AND PLASMA SUBSTITUTES

Blood grouping, Rh Compatibility, Collection, processing and storage of whole human blood, concentrated human RBC, dried human plasma, Human plasma protein fraction, Dried human serum, Human fibrinogen, Human thrombin, Human normal Immunoglobulin, Plasma substitutes- Ideal requirements, PVP, Dextran 40, control ofBlood products, Transfusion products

UNIT-V: PHARMACEUTICAL PRODUCTS

Fundamentals of Therapeutic categories such as Analgesics, Antipyretic, Anti-inflammatory drugs, Anesthetics, Antacids, Alkaloids, Glycosides, Anti-neoclassic drugs, Biologicals (Immunizing agents and allergenic extracts), Chemoterapy of Tuberculosis and Urinary tract infections.

Text books:

1. Brahmankar DM and Sunil B Jaiswal, “Biopharmaceutics and Pharmacokinetics- A Treatise”, Vallabh Publications, Prakashan, 2006,
2. Purohit SS, Kakrani HN and Saluja AK., “Pharmaceutical Biotechnology”, Student Edition Jodhpur, 2003
3. Cooper and Guns, “Pharmaceutics”, CBS publishers, 1989

Suggested Reading:

1. David B Troy and Paul Beringer, “Remington’s:The Science and practice of Pharmacy”, Vol 1 and 2, Lippincott Williams & Wilkins Publications, 2006
2. Tripathi, K.D. "Essentials of Medical pharmacology", Jaypee Brothers Medical Publishers 6th Edition , John Wiley, New Delhi,2000.

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BT 415 **DOWNSTREAM PROCESSING 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 provide an opportunity to experimentally verify the theoretical concepts studied.
2. To give extensive exposure to various unit operations of downstream processing.
3. Students are explained how to design protocol for separation of bioproduct based on characteristics

Course Outcomes:

1. Be able to understand the fundamentals of downstream processing for biochemical product recovery.
2. Be able to calculate operating parameters for a given downstream processing unit operation.
3. Be able to develop their skills in the purification of bioproducts from fermentation broths.
4. Be able to design chromatographic separation process for a given compound.
5. Be able to arrange unit operations into an appropriate sequence for the purification of a given type of biological product.
6. Be able to analyze and summarize scientific results

LIST OF EXPERIMENTS:

1. Cell Disruption of microorganism using sonicator.
2. Cell Disruption of microorganisms using lysozyme.
3. Homogenization of microbes / plant material using pestle and mortar.
4. Recovery of bulk proteins by Aqueous Two Phase Extraction.
5. Separation of solids from liquid by Sedimentation
6. Separation of micro organisms from fermentation broth by Microfiltration.
7. Separation of solute particles by Dialysis.
8. Separation of alpha amylase by Ammonium Sulphate Precipitation.
9. Isolation and quantification of casein from milk by Isoelectric Precipitation.
10. Separation of biomolecules by Gel Exclusion Chromatography.
11. Purification of lysozyme from chicken egg white extract by Ion Exchange Chromatography.
12. Purification of proteins by Affinity Chromatography.
13. Determination of purity and molecular weight of proteins by SDS-PAGE
14. Extraction of Enzymes.
15. Extraction of Ethanol.

Text books:

1. David Plummer, “An introduction to Practical Biochemistry” 3rd edition, John Wiley & Sons
2. Principles and Techniques of Biochemistry and Molecular Biology by Keith John Walker John Walker,Cambridge University Press; 6 edition (2005).
3. Laboratory Manual in Biochemistry By J. Jayaraman, Kunthala Jayaramanj, New Age International

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BT416 TISSUE CULTURE 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 students should be able to understand explicitly the concepts of Plant Tissue culture and Animal tissue culture.
2. Develop their skills in plant tissues culture techniques.
3. Get extensive exposure to various techniques of plant cell and tissue culture.
4. To develop a protocol for genetic transformation using *Agrobacterium* strains.
5. The students will handle animal cell culture.

Course Outcomes:

1. Provides an opportunity to experimentally verify the theoretical concepts studied.
2. The course helps in gaining hands on training in developing protocols for various in vitro techniques: callus cultures, cell and suspension cultures etc.
3. The course experiences the students to establish *in vitro* techniques of micropropagation of crop/horticulture and medicinal plants.
4. The course enables student to establish a system of genetic transformation using Agrobacterium strains.
5. The handling experience of Protoplast isolation and culture helps them to produce somatic hybrids.
6. The course enables student to handle animal cell culture.

LIST OF EXPERIMENTS

1. Preparation of Plant tissue Culture Media
   i. Preparation of MS stock solutions
   ii. Preparation of MS callus induction media
2. Surface sterilization
3. Callus induction: Embryo Culture.
4. Meristem tip culture
5. Micro propagation of horticultural/medicinally important plants
6. Cell suspension cultures initiation and establishment.
7. Organogenesis and Embryogenesis.
8. Production of synthetic seeds.
9. Protoplast isolation (demo)
10. *Agrobacterium* mediated gene transfer: induction of Hairy roots
11. Preparation of Animal cell culture media
12. Preparation of cheek epithelium cells
13. Preparation of Primary cell lines
14. Cell counting and viability
15. Staining of animal cells
16. Preservation of cells

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BT 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 minute's 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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BT 421 **COMPUTER APPLICATIONS IN BIOPROCESS**

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 aims at providing knowledge on basic concepts in software development processes, Algorithm design and Process Models.
2. The course is designed to give an understanding on obtaining. solutions of differential equations by Euler`s, Modified Euler`s, Runge-Kutta methods
3. This course aims at providing an insight into the solution of set of simultaneous equations by Gauss elimination, Gauss Jordan and Gauss Seidel methods.
4. The aim of the course is also to give the students an understanding of obtaining solutions of numerical methods.

Course Outcomes:

At the end of the course student should

1. Be able to distinguish between different process models
2. Be able to formulate process models leading to set of ordinary differential equations and solution procedures numerical methods.
3. Be able to formulate process models leading to set of linear simultaneous equations and solution procedures.
4. Be able to formulate process models leading to transcendental and polynomial equations and solution procedures.
5. Understand the steps involved in optimization that are a prerequisite for the development of process flow sheets.
6. Be able to optimize biochemical process.

The Programs are to be written in "C" only

UNIT-I Computers and Software

Computers and Software: Computing environments, The software development processes, Algorithm design, Program composition, Quality Control, Documentation, Storage and •Maintenance, Software strategy. Process Models: Uses, Distributed & Lumped parameter models, Linear and Nonlinear models, Steady state and Dynamic models, Continuous and Discrete models, Empirical models. Formulation of Process Models: Momentum, mass and energy balances, constitutive rate equations, transport rate equations, biochemical kinetic rate expressions, thermodynamic relations. Review on "C" Language Fundamentals.

UNIT-II Function Approximation

Function Approximations by Linear and nonlinear least square analysis, Formulation Process Models leading to set of ordinary differential equations and solution procedures by Eulers, Modified Eulers and Runge Kutta methods.

UNIT-III Formulation of Process Models

Formulation of Process Models leading to set of linear simultaneous equations and solution procedures by Method of determinants, Gauss Elimination, Gauss Jordan, Jacobi and Gauss-Seidel methods.

UNIT-IV Process Models Leading to Transcendental and Polynomial Equations

Formulation of Process Models leading to transcendental and polynomial equations and solution procedures by Bi-section, Reguli-falsi, Newton Raphson, Richmond, Muller's and Bairstow methods

UNIT-V

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.**Text Books:**

1. Higher engineering mathematics by DR. B.S. Grewal, Khanna publishers (1998)
2. Numerical methods for Engineersby Steven C. Chapra and Raymond P Canale, 2nd edition, MCGraw Hill International edition, 1988.

Suggested books:

1. Computer Applications in Bioprocessing by Henry R. Bungay Volume 70/(2000) Springer.
2. Edger T.E., and Himmelbau D.M., "Optimization of chemical processes", McGraw Hill international edition, 1988
3. Bioprocess engineering Enrique Galindo and Octavio T. Ramírez Volume 16, Issue 7, (1998).

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BT422 BIOPROCESS ECONOMICS & PLANT 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 provide the students with knowledge about basic concepts in Interest, capital investment tax and depreciation;
2. Measures of economic performance.
3. This course aims at providing an insight into capital, overhead and manufacturing costs estimation
4. The course is designed to give an understanding of process design development and general design considerations.
5. This course aims at providing knowledge on design of batch and continuous sterilizers**,** Design calculations for immobilized enzyme kinetics.
6. To give insight about various types of valves, pumps, steam traps, spargers and impellers used in biotech industries.

Course Outcomes:

At the end of the course student should

1. Be able to carry out interest calculations and prepare balance sheets for business transactions.
2. Be able to determine the economic analysis of bioprocesses.
3. Carry out cost estimations for different industrial productions.
4. Develop process design, flow diagrams.
5. Carry out material and energy balances accurately
6. Be able to design filters for air sterilization, batch and continuous sterilizers, valves etc.

UNIT-I ECONOMIC EVALUATION

Capital cost of a project; Interest calculations, nominal and effective interest rates; basic concepts in tax and depreciation; Measures of economic performance, rate of return, payout time; Cash flow diagrams; Cost accounting-balance sheet and profit loss account; Break even and minimum cost analysis.

UNIT- II BIOPROCESS ECONOMICS

Bio-Products regulations; Economic analysis of bioprocess; Capital, overhead and manufacturing costs estimation; Case studies of antibiotics (Penicillin and Streptomycin), recombinant products, single cell protein, anaerobic processes and other fine chemicals.

UNIT- III INTRODUCTION TO PLANT DESIGN

Process design development: design procedures, design information and flow diagrams, material and energy balances, comparison of different process and design specifications; Optimization; General design considerations: Health and safety hazards, Environment protection, plant location and plant layout, plant operation and control;

UNIT- IV BASIC DESIGN PROBLEMS

Design examples on continuous fermentation, aeration, and agitation; Design calculation of filter for air sterilization; Design of batch and continuous sterilizers; Design calculations for immobilized enzyme kinetics; Practical considerations in designing of Bioreactor/Fermentor construction.

UNIT- V

Introduction to different types of valves, pumps, steam traps, spargers and impellers used in fermentation industries; Design exercise on trickle flow fermentor; Problems associated with design equations.

Text Books:

1. Plant Design and Economics for Chemical Engineers, 5/e
   Max S. Peters, Ronald E. West, (2003) McGraw-Hill Higher,
2. Biochemical Engineering -Humphrey, A. E.; Millis, JSTOR 1966.
3. Biochemical Engineering, by Harvey W. Blanch, Douglas S. Clark CRC; 1st edition (1997).
4. Biochemical Engineering Fundamentals by James; Ollis, David F. Bailey,1977, McGraw-Hill.

Suggested Reading:

1. Biochemical Engineering and Biotechnology Handbook by Bernard Atkinson, Ferda MavitunaGrove's Dictionaries; 2 edition (1992).
2. Bioprocess Engineering:Basic Concepts. Michael L. Shuler / Fikret Kargi, Reihe:Prentice ,(2001) Hall.
3. Plant Design and Economics for Chemical Engineers" by M. Peters and K. Timmerhaus, McGraw-Hill.
4. Bioprocess and Biosystems Engineering Dirk Weuster-Botz, ISSN: 1615-7591 Journal no. 449, Springer.

Elective-III

MOLECULAR MODELING & DRUG DESIGN

BT 471

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

Course Objectives:

1. Empirical force fields and Hydrogen bonding in different molecules.
2. Simulation methods to calculate Thermodynamic properties of molecules.
3. Molecular dynamics simulation of molecules by simple and continuous potential.
4. Practical aspects in setting and running the molecular dynamics simulation.
5. Montecarlo simulation method for rigid and flexible molecules.
6. QSAR between different protein ligand interactions.

Course Outcomes:

After completion of the course students gain knowledge in the following concepts:

1. Calculate Total energy of molecule by using force field potentials.
2. Calculate Internal energy, Heat capacity, Temperature, pressure.
3. Hard sphere potential, Continuous potential by Finite differential method.
4. Choosing the initial configuration and analyzing the results of computer simulation.
5. Simulation of polymers by Random walk method, Self avoiding walk method.
6. Classification of Drug Design. CADD to treat Alzheimer's and Tuberculosis diseases

UNIT- I: EMPIRICAL FORCE FIELDS AND MOLECULAR MECHANICS

Introduction to Molecular Mechanics, Coordinate system, Molecular graphics, Force fields, Bond stretching, Angle bending, Torsions, Out of plane bending motions, Electrostatic interactions, Vanderwalis interactions, Effective pair potentials, Hydrogen bonding.

UNIT- II: COMPUTER SIMULATION METHODS

Calculation of Thermodynamic properties, Phase space, Practical aspects of computer simulation, Periodic boundary condition, Boundaries monitoring Equilibrium, Truncating the potential and minimum image convention, Long range process, Analyzing results of simulation and estimating errors.

UNIT- III: MOLECULAR DYNAMICS SIMULATION METHODS

Molecular Dynamics using simple modules, Molecular Dynamics with continuous potentials: Finite difference methods and Predictor corrector integration method, Constraint Dynamics, Transport properties, Time dependent properties, Molecular Dynamics at constant Temperature and Pressure.

UNIT-IV: MONTECARLO SIMULATION METHODS

Metropolis methods, Importance of Hamiltonian equation, Montecarlo simulation of Rigid and Flexible molecules, Montecarlo simulation of Polymers: Lattice model & continuous polymer model, calculating chemical potential, Differences between Molecular dynamics & Montecarlo simulation method.

UNIT-V: APPLICATIONS OF MOLECULAR MODELING AND DRUG DESIGN

Production of Drugs in Pharmaceutical companies, CADD: Strucure Based Drug Design and Ligand Based Drug Design, Quantiative Structural Activity Relationship (QSAR) studies in Protein- Ligand interactions, Case studies of Alzheimers disease, Tuberculosis and Cancer etc.

Text books:

1. Molecular modeling principles and Applicatios AR Leach, Longman, (1996).
2. Molecular Dynamics simulation -Elementary Methods- John Wiley and Sons, (1997).

Suggested Reading:

1. Protein Engineering - Moody PCE and AJ Wilkinson. IRL press.
2. Introduction to protein structure by C. Brandon and J. Tooze, Garland, 2nd edition, (1998).
3. Essentials of Drug Designing V. Kothakar, Dhruv publications

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Elective-III

BT472 **IMMUNODIAGNOSTICS**

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

Course Objectives:

1. The students will learn the basic principles, procedures and applications of immunodiagnostic tests.
2. The students are introduced to engineer antibody by using rDNA technology
3. The students are illustrated to the steps involved in the develop, production and applications of monoclonal antibody technology
4. The students will learn the development of preventive agents such as vaccines
5. The students also learn the novel methods used for immunodiagnostics
6. Students will be introduced to immunoproducts IPR and its patenting.

Course Outcomes:

1. Students will demonstrate competence in diagnosing various diseases by using different types of immunodiagnostic tests.
2. Students can explain the concepts of validation and quality control as applied to antibody-based analytical systems.
3. Students will learn about development of monoclonal antibodies diagnosis, treatment and prevention of disease by using monoclonal antibody.
4. New methods of treating various diseases are being explored by vaccine development
5. The course is helpful to learn the novel techniques used in immunodiagnostics.
6. Students will learn what is patenting and how immunoproducts are patented

UNIT I INTRODUCTION

Principles of immunodiagnostic tests and their development, classification of immunodiagnostic tests, Immunodiagnostics techniques – Precipitation, Immunoelctrophoresis, Agglutination, RIA, ELISA, Fluoroimmunoassay, Luminescent immunoassay, Immunofluorescence, Cell separation techniques, Western blotting, Selection and preparation of reagents, Assay design, Antibody engineering, Catalytic antibodies, Applications of nanoparticles in immunodiagnostics.

UNIT II HYBRIDOMA TECHNOLOGY

Immunodiagnostics and preparation of tools: Hybridoma technique, monoclonal antibodies production, choice of host for immunization and myeloma cells, choice of immunogen, preparation of antigen for immunization, growth of myeloma cell lines, preparation of cells for fusion, cell fusion, selection and Screening of Hybridoma, purification and application (biochemical research, clinical diagnosis and treatment) of monoclonal antibodies.

- **UNIT III VACCINES**
- Whole organism Vaccines, Subunit vaccines - Herpes Simplex virus, Foot and Mouth disease, SARS, Peptide vaccines - Foot and Mouth disease, Malaria, Live recombinant vaccines- Cholera, Salmonella, Vector vaccines - directed against viruses and bacteria, Purified vaccines, Conjugate polysaccharide vaccines, DNA vaccines, Antifertility vaccines.

UNIT IV NOVEL TECHNIQUES IN IMMUNODIAGNOSTICS

Imaging as an Immunodiagnostic Tool, Multicolor Flow Cytometry, Immunoglobulin and Free-light Chain Detection, Methods for Autoantibody Detection, Immunodiagnostic of Allergy, Multiplex Analysis of Cytokines, Immunomonitoring of Clinical Trials, Immunological Assays Used in Vaccine Clinical Trials

UNIT V IPR ON IMMUNO PRODUCT

Intellectual Property Rights, Patenting, General Agreement on Trade and Tariff, Application of transgenic organisms for the production of immune product, Patenting of biological material.

Text books:

1. Edwards R, "Immunodiagnostics: A practical approach" Oxford University Press, 1999.
2. Rastogi SC, "Immunodiagnostics Principles and Practice" New Age Publishers, 1996

Suggested Reading:

1. Thomas J. Kindt, Barbara A. Osborne, Richard Goldsby, W. H. Freeman, " Kuby Immunology", 6th edition, 2006.
2. Ralph M. Aloisi Lea & Febiger Principles of Immunology and Immunodiagnostics by, 1988.

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Elective-22

BT 473 TISSUE ENGINEERING

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

Course Objectives:

1. Understand the fundamental principles and elements of tissue engineering.
2. Get insight into the roles of cells, tissue organization and matrix in tissue engineering.
3. To learn the practical approach of carrying out tissue culture.
4. Learn about the different materials use as biomaterials.
5. Understand the role of stem cells in tissue engineering.
6. Gain knowledge into the medical applications of tissue engineering.

Course Outcomes:

1. Graduates are aware of the upcoming concept of tissue engineering.
2. The importance of the cell matrix in tissue engineering is highlighted to the graduates.
3. The graduates learn about in vitro culturing and the parameters of importance.
4. Students are able to discuss the potential of stem cells in tissue engineering for wound healing.
5. Graduates understand the need of compatible biomaterials to support growth and differentiation of stem cells into functional organs.
6. The graduates understand the scope of tissue engineering in producing organs for therapeutic applications.

UNIT – I INTRODUCTION TO TISSUE ENGINEERING

Basic definition and overview; General scientific issues; History of Tissue engineering, Basic steps in tissue engineering; Ethical issues.

UNIT - II CELLS AND TISSUE ORGANIZATION

Cells- cell growth and death; cell differentiation; Cells in tissues and organs.
Cell to cell interactions; cell adhesion molecules (CAM)
Organization of cells into higher ordered structures- Mesenchymal cells; EMT, MET; Molecular mechanisms and control of EMT process. Tissues- Epithelial, connective; Vascularity; angiogenesis; wound healing. ECM (extra cellular matrix) –components; dynamics of cell-ECM interaction.

UNIT – III FUNCTIONAL TISSUE ENGINEERING

Cell and tissue culture- media; culture initiation; transformation and immortalization; validation; differentiation; maintenance of cells in vitro; cryopreservation.Stem cells in tissue engineering Bioreactors for tissue engineering- Bioreactor design requirements; Spinner flask bioreactors . Rotating-wallbioreactors , Compression bioreactors, Strain bioreactors, Hydrostatic pressure bioreactors, Flow perfusion ioreactors, Combined bioreactors

UNIT- IV BIOMATERIALS OF TISSUE ENGINEERING

Scaffolds- fabrication; 3D scaffolds
Biodegradable polymers; synthetic polymers; hybrid of synthetic and biological polymers; prosthetic devices.
Engineering biomaterials for tissue engineering.

UNIT-V APPLICATIONS OF TISSUE ENGINEERING

Tissue replacement –crucial factors
Skin grafting
Bone tissue engineering; Cardiac tissue engineering; Neural tissue engineering; Vascular tissue engineering; as models in cancer and drug discovery.

Text Books:

1. Principles of tissue engineering. Robert.P.Lanza, Robert Langer & Vacanti. Academic Press. 2nd edition 2000.
2. Tissue engineering. B. Palsson, J.A. Hubbell, R. Plonsey & J.D. Bronzino. CRC Taylor & Francis.

Suggested Reading:

1. Tissue engineering- Design, practice & reporting, Bernard prish. Woodhead Publishing Ltd. Cambridge. UK 2009.
2. Methods of tissue engineering. Atala O.P & Lanza.L. Woodhead Publishing Ltd. Cambridge. UK 2009.

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Elective-IV

BIOPROCESS VALIDATIONS & CURRENT GOOD MANUFACTURING PRACTICES

BT481

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

Course Objectives:

1. Student is taught with the concepts of prospective process validations and analytical methods validations.
2. Students are explained the development of validation protocol and methods of evaluation.
3. Students are explained with good laboratory practices with suitable examples.
4. Students are enlightened thoroughly the (SOP) of biotech process.
5. Students are taught with proper illustrations with the concept of waste minimization and zero contamination.
6. Students are taught and explained about health hygiene of persons involved.

Course Outcomes:

1. Apply prospective process validation and analytical methods in biotechnology industries.
2. Students will be capable of developing validation protocols and methods of evaluation in Quality control department of biotechnology industry.
3. Students will apply good laboratory practices in real life situations in bio process industriesand laboratories of R&D and quality control units.
4. Students will apply SOP in process operations of biotech industries.
5. Students will apply the concepts of waste minimization and zero contamination in process units of biotechnology industries.
6. Students will apply the concepts of personal hygiene of employees of biotech industries and implementation of good health practices.

UNIT- I: BIOPROCESS VALIDATIONS

Validations- Prerequisites, Process Design & testing process characterization, Process Optimization, Validation Options, Prospective process validation, Retrospective validations, Concurrent validations, Revalidation, Organizing validation studies, Analytical methods validation, cleaning validation, pre-validation verification, Documentation, Control of cleaning materials & ancillary tools, frequency of cleaning, Development of validation protocol, Method of Evaluation.

UNIT- II: GOOD LABORATORY PRATICES (GLP)

Introduction to Good Laboratory Practices, Responsibilities in GLP, Quality assurance and facilities for GLP, Computational processes in GLP.

UNIT III: STANDARD OPERATING PROCEDURES (SOP)

Standard Operating Procedures (SOP) and Guidelines and regulations of PDA and ICH for GLP and GMP.

UNIT- IV: GOOD MANUFACTURING PRACTICES (GMP)

Introduction to GMP; Manufacturing & Quality control facilities; Sanitation & Hygiene; Control of raw materials, Packaging Materials, manufacturing processes, Minimization or Zero Contamination, and finished products; Documentation and compliance of GMP.

UNIT- V:GMP FOR BIOLOGICAL PRODUCTS

Products based on immunological principles, Layouts and Designs of Manufacturing Areas, Equipment designs and operations, Standard operating procedures for Production, Quality control, Labeling, Records and Waste Disposal; Health & hygiene of Persons involved.

Text Books:

1. How to Practice GMPs-PP Sharma.
2. Good Laboratory Practice: The Why and the How by Jurg P. Seiler, Springer-Verlag Berlin.

Suggested Reading:

1. Bioprocess Validation: The Present and Future by PhD Trevor Deeks, pub: PDA/DHI (2007).
2. Process Validation in Manufacturing of Biopharmaceuticals: Guidelines, Current Practices, and Industrial Case Studies (Biotechnology and Bioprocessing Series),Informa HealthCare; 2 edition (2005).
3. The L&K Process Guide, The tool for biopharmaceutical drug development, Pub: L&K Biosciences.
4. Bioprocess Engineering: Basic Concepts, 2/E Michael L. Shuler, Fikret Kargi, Dokuz ISBN-13: 9780130819086, Publisher: Prentice Hall (2002).

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Elective-IV

BT482 FOOD BIOTECHNOLOGY

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

Course Objectives:

1. Student is made to understand the importance of food biotechnology and its nutritive value.
2. Students are taught the types of food available in the nature and its consumption value.
3. Students made to understand the food spoilage.
4. Students are enlightened about the importance of food processing.
5. Students are made aware of chemical and physical methods of food processing.
6. Student is made to understand the methods of food preservation and its control in food spoilage.

Course Outcomes:

1. Apply the fundamentals of food biotechnology to their real life situation.
2. Be able to differentiate types of food and explain their consumption value.
3. Be able to describe the types of pathogens and their effect on food.
4. Be able to describe the physical and chemical methods of food processing.
5. Be in a position to preserve the food material to avoid food spoilage.
6. By understanding the principles of biotechnology able to work in a suitable food industry.

UNIT-I SCOPE AND IMPORTANCE OF FOOD BIOTECHNOLOGY

Introduction to Scope and importance of food biotechnology, Nutritive value of the food ; consumption and structure of foods and the importance of industrial processing of foods, various technologies and methods in food preservation, processing and packaging, food grade polymers.

UNIT- II FOOD PRODUCTS

Introduction to Probiotics, Nutraceuticals and GM foods ; Development of Industrial Food products: High Fructose Corn syrup, Single Cell Protein and Fermented foods, Bakery Products, Beverages, Milk Products and Mushroom Development; Food labeling, Food standards.

UNIT- III FOOD SPOILAGE AND FOOD MICROBIOLOGY

Food spoilage, Bacterial agents of food borne illness; Clostridium, Salmonella, Vibrio and Shigella, non bacterial agents; helminthes, Protozoa, Algae, Fungi and Viruses.

UNIT- IV FOOD PROCESSING

Bio-processing : Enzymes and chemicals used in food processing for flavor development; Processing of meat, fisheries, vegetables, dairy products; Thermal processing of foods; Microwave heating; Thermal inactivation of microorganisms; Freezing and thawing methods of food processing.

UNIT- V FOOD PRESERVATION

Food preservation using Irradiation: Characteristics of Radiations of Interest in food preservation, Principles underlying the destruction of microorganisms by irradiation, Processing of foods for Irradiation, Legal status of food irradiation, Effect of Irradiation of Food constituents and Storage Stability; Food Preservation with low and High Temperatures and Preservation of foods by Drying, equipment for Drying.

Text Books:

1. Roger Angold, Gordon Beech & Taggart, "Food Biotechnology" 1st edition, Cambridge University Press, 1989.
2. Frazier, William, C.Westhoff, Dennisc , "Food Microbiology" 2nd Edition TATA Mcgraw Hill Publishers, 1989.
3. Norman Potter, Hotch Kiss, "food science" 2nd edition, chapman Publishers, 1996.
4. Kalidas Shetty, Gopinadhan Paliyath, Anthony Pometto, Robert E. Levin, "Food biotechnology" 2nd Edition, CRC Press, 1999.

Suggested Reading:

1. Ashok Pandey, "Biotechnology:Food Fermentation" Asia Tech Publishers Inc,New Delhi,1999.

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2. J.M.Jay, M.J.Loessner and D.A.Golden, “Modern food microbiology”, 7th edition,Springer,2006.
3.Romeo T. Toledo, “Fundamentals of Food Process Engineering”, 3rd edition, Springer, February, 2007.

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Elective-IV

BT483 **NANOBIOTECHNOLOGY**

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 concept of nanotechnology and nanobiotechnology
2. To educate students about significance of nano-size
3. To gain knowledge on the synthesis of nanomaterials
4. To gain knowledge on the characterization of nanomaterials
5. To have awareness about different types of Nanostructures
6. To get familiarize with applications of nanobiotechnology in different fields

Course Outcomes

1. Students will acquire the knowledge of multidisciplinary nature of nanotechnology
2. Students will be able to explain the nanoscale paradigm in terms of properties at the nanoscale dimension.
3. Students will be able to describe different methods used for the synthesis of nanomaterials
4. Students will have the knowledge of characterization of nanomaterials
5. Students will have awareness of nanostructures
6. Students will learn various applications of nanobiotechnology

UNIT-1 INTRODUCTION AND SIGNIFICANCE OF NANO DOMIAN

Nanotechnology - A Historical Perspective, definition of nanoscale with special reference to biosystems, scope and future prospects of Nanotechnology, Nanobiotechnology and Bionanotechnology, Opportunities and Challenges of Bionanotechnology; Limitations of micron size, need for nano-size—surface volume ratio significance, significance and key features of nano-Size, derivation of Bohr's atomic radius of a hydrogen atom, comparison of particle behavior at nano-size to Macro Size: Gold and Titania, advantages of scaling down—nano-size.

UNIT- II SYNTHESIS AND CHARACTERIZATION OF NANOMATERIALS

Synthesis of Nanomaterials – Top-down and bottom up approaches with examples, physical, chemical and biological methods, characterization of nanomaterials- Optical (UV-Visible/fluorescence), X-ray diffraction, Imaging and size-(Electron Microscopy- SEM, TEM), Atomic force microscopy, Scanning tunneling microscopy, Spectroscopy- NMR, Raman FT-IR and Plasma Resonance.

UNIT- III NANOSTRUCTURES

Smart materials, nanoscale biostructures, carbon nanotubes, nanowires, nanoshells, quantum dots, dendrimers, nanosomes, liposomes, virosomes, polymersomes.

UNIT- IV. GENERAL APPLICATIONS OF NANOBIOTECHOLOGY

Application of nanotechnology in medical diagnosis, drug discovery, drug development, drug delivery, Photodynamic Therapy.

UNIT- V. CURRENTAPPLICATIONS OF NANOBIOTECHOLOGY

Application of nanotechnology in Protein Engineering, Tissue engineering, Agriculture, Environment, food processing, Nanotechnology and Nanoparticles: Clinical, Ethical, and Regulatory Issues.

Text books:

1. Christof M. Niemeyer and Chad A. Mirkin, "Nanobiotechnology: Concepts, Applications and Perspectives" Wiley Publishers, April 2004.
2. Mark Ratner and Daniel Ratner, " Nanotechnology: A Gentle Introduction to Next Big Idea", Low Price edition, Third Impression, Pearson Education

Suggested Reading:

1. David S Goodsell, "Bionanotechnology", John Wiley & Sons, 2004.
2. Debasis Bagchi, Manashi Bagchi, Hiroyoshi Moriyama, Fereidoon S hahidi, "Bio-Nanotechnology: A Revolution in Food, Biomedical and Health Sciences" Wiley -Blackwell, 2013.
3. Elisabeth S P, Aravind P, "Bionanotechnology", Morgan & Claypool publishers, 2007

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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.

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BT423 **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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BT 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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16MCC101 **DISCRETE MATHEMATICS**

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

Course Objectives:
Students will:
1. Gain Logical and Mathematical ability to introduce most of the basic terminologies used in computer science with particular reference to the relationships among the discrete structures.
2. Learn about Boolean algebra.
3. Apply the concepts of Relations, Functions, properties of Integers and Set Theory.
4. Learn about principle of Inclusion, Exclusion and Generating Functions.
5. Understand the concept of Recurrence Relations, Groups and Algebraic Structures
6. Model and analyze the computational processing using combinatorial methods.

Course Outcomes:
After completion of the course the students would be able to:
1. Apply knowledge of the concepts needed to test the logic of a program.
2. Apply knowledge of Boolean algebra and Set Theory.
3. Apply knowledge of Properties of Integers, Relations and Functions.
4. Expose principles of Inclusion and Exclusion, Generating Functions, Recurrence Relations, Groups and Algebraic Structures.
5. Synthesize the indirection of hypothesis and simple indirection methods.
6. Prove elementary properties of modular arithmetic and explain their applications in Computer Science.

UNIT – I
Fundamentals of Logic: Basic Connectives and Truth Tables, Logical Equivalence, Logical Implication, Use of Quantifiers, Definitions and the Proof of Theorems. **Boolean algebra**: Switching Functions, Logic gates, Don't Care Condition **Set Theory**: Sets and Subsets, Set operations and the Laws of Set theory Counting and Venn Diagrams.

UNIT – II
Properties of Integers: The well-ordering principle, Recursive definitions, The Division Algorithm, Euclidean Algorithm, Fundamental theorem of arithmetic. **Functions:** Cartesian product, Functions, Onto Functions, Special Functions, Pigeonhole Principle, Composition and Inverse Functions, Computational Complexity. **Relations**: Partial Order Relations, Lattices, Equivalence Relations and Partitions.

UNIT – III
Principle of Inclusion and Exclusion: Principles of Inclusion and Exclusion, Generalization of principle, Derangements, Rooks Polynomial, Arrangements with Forbidden Positions.
Generating Functions: Introductory examples, Definitions and examples, Partition of Integers, Exponential generating function, Summation operator.

UNIT – IV
Recurrence Relations: First-order linear recurrence relation, Second-order linear homogeneous recurrence relations with constant coefficients, Non- homogeneous recurrence relations, Divide-and-conquer algorithms. **Algebraic Structures**: Definition, Examples and properties. **Groups**: Definition, Examples and elementary properties, Homomorphism, Isomorphism and Cyclic groups.

UNIT – V
Graph Theory: Definitions and examples, Sub graphs, Complements and graph isomorphism, Vertex degree, Planar graphs: Hamiltonian paths and Cycles, Graph coloring.
Trees: Definitions, Properties and examples, Rooted Trees, Spanning Trees and Minimum Spanning Trees.

Text Books:
1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, 4th Edition, 2003.

Suggested Reading:

1. Kenneth H Rosen, "Discrete Mathematics and its Applications" Tata McGraw Hill, 6th Edition, 2007.
2. J.P Tremblay & R. Manohar, "Discrete mathematical Structures with Applications to computer science" McGraw Hill. 1987.
3. Joe L. Mott, A.kandal & T.P. Baker, "Discrete mathematics for compute scientists, & mathematicians", Prentice Hall N.J., 1986
4. Kevin Ferland, "Discrete Mathematics", Houghton Mifflin Company, 2009.

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16MCC102 COMPUTER PROGRAMMING AND PROBLEM SOLVING

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

Course Objectives:
Students will:
1. Understand algorithms, flow charts and pseudo codes.
2. Learn programming environment.
3. Gain the basic terminology used in computer programming.
4. Understand different data types in C programming.
5. Understand the decision structure, loops, functions, arrays, pointers, strings, structures and files.

Course Outcomes:
After completion of the course, the students would be able to:
1. Design Algorithms and Flowcharts to solve the various problems.
2. Execute the programs.
3. Apply different data types in various programs.
4. Apply the built-in functions, customized functions and preprocessor directives in various programs.
5. Apply the Arrays and Pointers for solving the problems.
6. Apply the Strings and Structures, dynamic memory allocation techniques and files for solving the various problems.

UNIT – I
Algorithm, flowchart, pseudo code, Structured Programming, program development steps, creating and running programs, structure of a C program, character set, keywords, identifiers, constants, basic data types and sizes, variables, operators, operator precedence and associativity, expressions, evaluating expressions, type conversions, basic formatted Input/output statements, decision control structures: if and switch statements, loop control structures: while, do-while and for, continue, break.

UNIT – II
Functions: Basic concepts, user defined functions, parameter passing, local variables, global variables, recursive functions, comparison of iteration and recursion, standard library functions, header files, storage classes, preprocessor.

UNIT – III
Arrays: Basic concepts, one-dimensional array, passing arrays to functions, searching and sorting: linear search, binary search and bubble sort, two-dimensional array, multi-dimensional array.
Pointers: Basic concepts, pointers as function arguments, pointer arithmetic, pointers to pointers, pointers and one-dimensional arrays, pointers and two-dimensional arrays, array of pointers.

UNIT – IV
Strings: Basic concepts, string I/O operations, pointers and strings, string manipulation functions. **Structures**: Declaration, definition and initialization of structures, accessing structures, nested structures, array of structures, structures and functions, pointers to structures, unions, enumerated types, typedef.

UNIT – V
Dynamic memory management functions, command line arguments. **Files**: Basic concepts, text files, binary files, basic file I/O operations, sequential-access files, random-access files.

Text Books:

1. Pradip D &Manas G, “Programming in C”, 2nd edition, Oxford University Press, 2007.
2. B.A. Forouzan and R.F.Gilberg,”Computer science, A structured programming approach using C”, 3rd edition, Cengage learning, 2007.

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Suggested Reading:

1. BW Kernighan DM Ritchie, “The C programming Language”, 2nd edition, Prentice Hall India, 1998.
2. P.J Deitel and H.M Deitel , “C How to program” , 6th edition, PHI, 2010.
3. Yashwant Kanetkar, “Let us C”, 13th edition, BPB Publications, 2013.
4. E Balaguruswamy, “Programming in ANSI C”, 5th edition, Tata McGraw-Hill, 2007.
5. K R Venugopal& S R Prasad, “Mastering C”, McGraw-Hill, 2007.

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16MCC103 **ELEMENTS OF INFORMATION TECHNOLOGY**

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

Course Objectives:
Students will:
1. Understand concepts of Information Technology and its applications.
2. Understand the physical and logical structure of the computer.
3. Have knowledge of the concepts of Networks and Communication Technology.
4. Obtain Knowledge of Files and Databases.
5. Understand the flow of information and the various levels of management within an organization.
6. Identifying security issues of computers and communication systems.

Course Outcomes:
After completion of the course, the students would be able to:
1. Get concepts of Information Technology and its Applications.
2. Identify the physical and logical structure of the computer.
3. Gain the knowledge of Network and Communication Technology.
4. Become familiar with the use of Files and Databases.
5. Gain the knowledge of flow of information in an organization and the various levels of management with in an organization.
6. Handle security issues of computers and communication systems.

UNIT -I
Introduction to Information Technology: Data, Information, Basic operations of Computers, Hardware: Input, Output, Memory, Communication, **Software**: **System software**: Operating System, Device drivers, Utility programs, GUI, **Application software**: Ways to obtain application software, Types of application software, Five sizes of computers, **Common operating systems**: DOS, MAC OS, Windows: XP, VISTA, Windows 7.0, Network OS, Hand held devices OS.

UNIT -II
Hardware: Generations of Computers, Measuring Capacity, Binary Coding Schemes, Number System, Block diagram of Computer, **Micro Computer System Unit**: Computer case, Power supply, Mother Board, Chips, CPU, Memory, Ports and Cables, **Input Devices**: Keyboard, Pointing devices, Source data entry devices, Audio and Video devices, Digital cameras, Speech recognition systems, RFID, Sensors, human biology input device, **Output Devices**: Soft copy output, Hard copy output, Mixed output devices, **Secondary Storage Device**: Floppy disks, hard disks, optical disks, flash memory, magnetic tape, online secondary storage, smart cards.

UNIT -III
Network communications: Digital basics of computers, **Networks**: Benefits of networks, Client – Server and Peer to Peer Networks, Types of Networks, Components of Networks, Intranet, Extranet and VPNS, Network Topologies. **Communications**: Wired and Wireless Communication Media, Cyber threats, Hackers and Safe Guards, **Internet and World Wide Web**.

UNIT- IV
Files & Databases: Data Storage Hierarchy, Types of Files, Key Field, Compression and Decompression, File Management Systems, **Database Management Systems**: Benefits of DBMS, DBA, Database Models, Data Mining, E-Commerce, Ethics of Using Databases.

UNIT -V
Information Systems: Qualities of good information, Information flows within an Organization, Computer Based Information Systems: OIS, TPS, MIS, DSS, ESS and ES. **System Development**: Six phases of system analysis and design. **Software Development**: Programming as a five step procedures. Five Generations of Programming Languages, **Security Issues**: Threats to Computers & Communication Systems. Safe guarding computers and communications.

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Text Book:

1. Williams B.K. Sawyer et.al. "Using information Technology", 9^{th} Edition, Tata McGraw Hill, 2011.

Suggested Reading:

1. Aksoy & DeNardis" Introduction to Information technology", Cengage Learning, 2006.
2. Dennis P. Curtin, Kim Folley, et.al. "Information Technology, The breaking Wave", Tata McGraw Hill, 1998.
3. ITL Edn Solutions Ltd. "Introduction to Information Technology", Education, 2005.

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16MBC128 MANAGERIAL ECONOMICS AND FINANCIAL 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:
Students will:
1. Introduce managerial economics and demonstrate its importance in managerial decision making.
2. Develop an understanding of demand and relevance of it's forecasting in the business.
3. Examine the economic analysis of production process in relationship with inputs.
4. Explain different costs and their relationship with the output.
5. Explain the concept of Accountancy and provide knowledge on preparation and analysis of Final accounts.
6. Understand the importance of project evaluation in achieving a firm's objective.

Course Outcomes:
After completion of the course, students will be able to:
1. Apply fundamental knowledge of Managerial economics' concepts and tools.
2. Understand various aspects of demand analysis and forecasting.
3. Analyze production function in terms of best combination of inputs.
4. Decision the best cost and benefits to achieve the objectives.
5. Analyze different opportunities and come out with best feasible capital investment decisions.
6. Understand accountancy concepts and conventions, final accounts and financial analysis.

UNIT - I:
Introduction to Managerial Economics : Definition, Nature and Scope of Managerial Economics, Micro Economics vs Macro Economics. Relationship of Managerial economics with other disciplines- Mathematics, Statistics, Accounting, and Operations Research. Role and responsibilities of Managerial economist in Business decisions. Fundamental concepts of Managerial economics - Opportunity cost concept, Principle of Time perspective, Incremental principle, discounting principle, and Equi-marginalism.

UNIT- II:
Demand Analysis : Meaning of Demand, Determinants of demand, types of demand, Individual vs Market Demand, Demand schedule, Demand curve and Demand function. Law of Demand and its exceptions. Elasticity of Demand- Definition, Types, and Measurement of Elasticity of Demand. Demand Forecasting- Factors governing demand forecasting, Methods of demand forecasting (Survey method, Statistical method, Expert opinion method, Test marketing, and judgmental approach).

UNIT - III:
Production and Cost Analysis : Production Analysis: Concept and Meaning of production-Factors of production, Production Function, law of variable proportions (with one variable and two variable inputs), Iso-quants and Iso-costs, Laws of returns, Economies and dis Economies of scale - internal and external economies. Cost analysis: Cost concepts - Actual vs opportunity cost, Incremental and sunk cost, Short run and long run cost, Fixed and variable cost. Cost output relationship in short -run and long-run.
Break Even analysis (BEA) – Break even chart, Determination of Break Even Point (simple numerical problems) Margin of safety. Managerial applications, and limitations of BEA.

UNIT - IV:
Introduction to Financial Accounting : Definition, Concepts and conventions of Accounting, Principles of double entry book keeping, Preparation of journal, ledger and Trial balance. Preparation of Financial statements- Trading and profit and loss account, and Balance sheet with simple adjustments.

UNIT –V:
Capital Management and Capital Budgeting: Significance of capital, Types of capital and sources of capital. Meaning of capital budgeting, Importance of capital budgeting. Methods of capital budgeting- Payback period

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method, Average rate of Return (ARR), Net present value method (NPV) Internal rate of return method (IRR) Profitability Index. (Simple Numerical Problems).

Text Books:

1. P.L. Mehta,"Managerial Economics – Analysis, Problems and Cases" , Sultan Chand &Sons Educational, 2011.
2. Grawal T.S, Introduction to Accountancy", S.Chand Publishers, 2009.
3. Pandey, I.M, Financial management, 10th Ed.Vikas Publishing House, 2010.

Suggested Reading:

1. Varshney R.L. K.L. Maheswari Managerial economic, Sultan Chand.
2. J.C.Pappas and E.F.Brigham, Managerial Economics.
3. Maheswari, S.N, Introduction to Accountancy, Vikas Publishing House, 2005.
4. M. Kasi Reddy & S.Saraswathi, Managerial economics & Financial Accounting, PHI 2007.

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16EGC101 **PROFESSIONAL COMMUNICATION IN ENGLISH**

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:
1. Understand the role and importance of communication and to develop their basic communication skills in English.
2. Improve the students' listening skills and introduce them to different reading strategies.
3. Train students to use language appropriately for interviews, presentations and public speaking
4. Encourage the all-round development of students by focusing on soft skills.
5. Develop the students writing skills, career skills and make them industry ready.

Course Outcomes:
After completion of the course, students would be able to:
1. Apply critical and creative thinking abilities necessary for effective communication in today's business world.
2. Demonstrate competency in writing effective paragraphs, letters and reports.
3. Become effective, confident speakers and deliver persuasive presentations.
4. Understand the nuances of listening comprehend texts and draw inferences and conclusions.
5. Understand the significance of soft skills in the working environment.

UNIT – I:
Understanding Communication in English: Meaning, definition, Nature and Scope of Communication, Importance of Communication, Process of Communication, Intrapersonal and interpersonal communication, One way vs. Two way communication. Barriers to Effective Communication, Overcoming the Barriers. Communication in a business organization: Internal (Upward, Downward, Horizontal, Grapevine, Problems, Solutions) and External Communication. Strategies for conducting successful business meetings.

UNIT-II
Developing Listening & Reading Skills: Process and Types of listening. Problems in comprehension and retention. Barriers to listening, effective listening strategies. Note – taking. Process and purpose of reading. Reading Techniques-Skimming, Scanning, inferences and conclusion. Reading comprehension-known and unknown passages.

UNIT – III
Soft Skills: Introduction to Soft skills, Hard skills vs Soft skills, Public Speaking, Presentation Skills and techniques, Body Language, Leadership skills, Team Building, Decision Making, Business Etiquette - Email & Telephone Etiquette.

UNIT – IV
Written Communication: Sentence Structures & Paragraph Writing. Letter Writing-form, structure, layout. Sales Letters. Basics of Official Correspondence: Handling Correspondence, Receipt and Dispatch of Mails, Filing system, Classification of Mails; Quotations, Orders, Tenders. Information Transfer.

UNIT-V
Career Skills: Resume Writing, Elements of an Effective Resume, Application Letters, Job Interview –Purpose, Types, Interview Skills & Techniques. Grammar & Vocabulary.

Text Books:
1. **Vibrant English**, Orient Blackswan Ltd.

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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. Alok Jain, P.S. Bhatia and A.M. Shiekh, **Professional Communication Skills** S. Chand & Company Ltd., 2005
4. R.C.Sharma & Krishna Mohan, **Developing Communication Skills, Business correspondence and report writing** Tata McGraw Hill
5. Evans, D, **Decision maker**, Cambridge University Press, 1997.
6. Shiv Khera, **You Can Win,** Macmillan Books – Revised Edition, 2003
7. Stephen Covey **7 Habits of Highly effective people,** Free Press

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16MCC104 COMPUTER PROGRAMMING LAB USING 'C'

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

Course Objectives:
Students will:
1. Learn programming environment.
2. Gain the basic terminology used in computer programming.
3. Understand different data types in C programming.
4. Understand the decision structure, loops, functions, arrays, pointers, strings, structures and files.

Course Outcomes:
After completion of the course, the students would be able to:
1. Write, compile, debug and execute the programs.
2. Apply various data types in various programs.
3. Apply the built-in functions and customized functions for solving the programs.
4. Use the decision structures, loop structures, functions, and arrays in various programs.
5. Apply pointers, strings and structures in various programs.
6. Write programs using files.

C-Programs:
1. Write a program to calculate the area of a circle, rectangle, square and triangle.
2. Write a program to find the Roots of a Quadratic Equation $ax^2+bx+c=0$, where $a>0$.
3. Write a program to find the biggest of three different numbers by using nested if – else statement.
4. Write a program to find the division of the student using percentage of marks.
5. Write a program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement).
6. Write a program to find max, min and sum of given set of numbers.
7. Write a program to find the sum of individual digits of a positive integer.
8. Write a program to find the factorial of a given positive number.
9. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
10. Write a program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
11. Write a program to find the reverse of the given positive integer and check reverse number is palindrome or not.
12. Write a program to find the sin(x) value using series expansion. (Hint: $\sin(x) = x - x^3/3! + x^5/5! - \ldots..$)
13. Write a program to find the cos(x) value using series expansion. (Hint: $\cos(x) = 1 - x^2/2! + x^4/4! - \ldots..$)
14. Write program for the following using non-recursive functions.
    i) To find the factorial of a given integer.
    ii) To find the GCD (greatest common divisor) of two given integers.
15. Write program for the following using recursive functions.
    iii) To find the factorial of a given integer.
    iv) To find the GCD (greatest common divisor) of two given integers.
16. Write programs using functions to perform the following search techniques
    i) Linear search ii) Binary search
17. Write a program to implement bubble sort technique.
18. Write program using function to perform the Additions of Two Matrices
19. Write program using function to perform the Multiplication of Two Matrices
20. Write program using function to perform the Transpose of a given Matrix
21. Write a program to display the array elements from last index to first index and display the even and odd elements sum.
22. Write a program to demonstrate call by reference mechanism by swapping two integers.
23. Write a program to find the number of characters, words and sentences in the given string.

24. Write a program to copy the contents of one string into another string using pointers.
25. Write a program to concatenate two strings without using strcat library function.

26. Write a program that uses functions to perform the following operations using Structure complex.
    i) Reading a complex number
    ii) Displaying a complex number
    iii) Addition of two complex numbers
27. Write a program that uses functions to perform the following operations using Structure complex.
    i) Reading a complex number
    ii) Displaying a complex number
    iii) Multiplication of two complex numbers
28. Write a program which counts number of characters, words and sentences in the file.
29. Write a program which copies contents of one file into another file.
30. Write programs to demonstrate sequential access files.
31. Write programs to demonstrate random access files.

Suggested Reading:

1. E Balaguruswamy, “Programming in ANSI C”, 5th edition, Tata McGraw-Hill, 2007.
2. K R Venugopal & S R Prasad, “Mastering C”, McGraw-Hill, 2007.
3. Yashwant Kanetkar, “Let us C”, 13th edition, BPB Publications, 2013..

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16MC C105 ELEMENTS OF INFORMATION TECHNOLOGY LAB

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

Course Objectives:
Students will:
1. Have knowledge of physical and logical structure of compute system.
2. Have hands on learning of MS-Word features such as section breaks, formatting, Mail Merge, Macros.
3. Gain knowledge of MS-Excel features such as Formulas and Functions and Different type of charts.
4. Acquire knowledge of MS-PowerPoint features.
5. In-depth learning of MS-Access features such as Creation of databases, Queries, Forms and Reports.
6. Learn basic dollar prompt commands in Linux.

Course Outcomes:
After completion of the course, students would be able to:
1. Assemble System and Load Software in the system
2. Create professional MS-Word documents
3. Efficiently generate Excel documents.
4. Give efficient presentations.
5. Handle various database applications.
6. Use basic dollar prompt commands in Linux.

Lab Experiments:
1. Identify and describe the relationships and role of the components of the "Logical' Diagram of the computer. (e.g. processor, RAM, ROM, BIOS, input, output, storage.)
2. Relate the "logical" diagram of a computer system to the "physical" system by Identifying physical components of a computer and describing their purpose. (e.g. the Processor, memory chips, motherboard, disk drives, and controller cards such as AGP Board, network cards, sound card, as well as parallel and serial ports etc.)
3. Assemble the computer which they will use and load the OS with partitions for Windows and Linux, configure for network connection
4. Troubleshoot his/her PC
5. Install/Uninstall SW/HW on his/her PC from time to time
6. Identify and distinguish between various types of application software. by describing and using them. (e.g. word processor, spreadsheet, database, browser, mailers etc.)
7. Distinguish between various commercially available systems by relating the cost to Features available on each system
8. **MS Word:** Create documents with standard formatting commands, single/multi Column, breaks, insert pictures/objects, drawings, hyperlinks, header/footer, and tables, Mail Merge, Macros.
9. **MS Power Point:** Create presentations with preset animations, using different layouts, Backgrounds, slide master, insert pictures/objects, drawings, hyperlinks, header/footer, Tables
10. **MS Excel:** Creating worksheets with various kinds of data, making charts, conditional Formatting, awareness of the various functions- statistical, date/time, math/trig etc, ability to explore (help) and use these functions if need be, demonstration through some Common functions like sum, average, standard deviation, logical and information.
11. **MS-Access:** Creation of database, queries, forms, Reports using student information system.
12. Learning of basic Dollar prompt commands in Linux.

Suggested Reading:

1. Williams B.K. Sawyer et.al. "Using information Technology", 9th Edn. Tata Mc-Graw Hill, 2011.
2. Srivastava S.S. “MS OFFICE”, Laxmi Publications, New Delhi.
3. Behrous A Fourzan, Richard F Gilberg “Unix and Shell Programming: A Text Book”, Thompson Learning 2003.

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16EGC102 PROFESSIONAL COMMUNICATION LAB

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

Course Objectives:

Students will:

1. Introduce to phonetics and the different sounds in English.
2. Familiarize with the software and give them sufficient practice in correct pronunciation.
3. Speak English correctly with focus on stress and intonation.
4. Participate in group discussions with confidence and to make effective presentations.
5. Plan and prepare for an interview, process of interview and interview techniques.

Course Outcomes:

After completion of the course, students would be able to:

1. Understand the speech sounds in English and the nuances of pronunciation.
2. Understand tone, intonation and rhythm and apply stress correctly.
3. Participate in group discussions with clarity and confidence.
4. Speak confidently on stage with appropriate body language.
5. Plan, prepare and face interviews with confidence.

Syllabus:

1. Introduction to English Phonetics: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. Sound system of English: Phonetic sounds and phonemic sounds, introduction to International Phonetic Alphabet, classification and description of English phonemic sounds, minimal pairs. The syllable: types of syllables, consonant clusters
3. Word stress: Primary stress, secondary stress, functional stress, rules of word stress.
4. Listening skills – practice with IELTS and TOEFL material
5. Situational dialogues and role play.
6. Group Discussions – dynamics of group, intervention, summarizing, modulation of voice and body language.
7. Presentation Skills – Elements of effective presentation – Structure of presentation – Presentation tools – Body language. Creating an effective PPT
8. Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews.

Suggested Reading:

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

16MCC106 **OBJECT ORIENTED PROGRAMMING**

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

Course Objectives:
Students will:

1. Learn java basics & object oriented programming principles.
2. Know the concepts of interfaces, packages.
3. Get the concepts of exception handling in java.
4. Acquire the concept of multithreading
5. Interpret the concepts on I/O package.
6. Understand the basic concepts of Applets and AWT.

Course Outcomes:
After completion of the course, the students would be able to:

1. Gain the knowledge on object oriented programming concepts.
2. Create classes and objects.
3. Acquire knowledge on multithreading and exception handling.
4. Understand the role of Strings and I/O Streams.
5. Design and Develop the GUI Components.
6. Perform event driven programming.

UNIT -I
Object Oriented Programming: History of java, and evolution of java, java Buzzwords, Object Oriented Programming, Data types, Variables and Arrays, Operators, Control Statements,

UNIT -II
Introduction To Classes: Classes, Methods, Constructors, This keyword, finalize method, Garbage Collection, Overloading, Overriding, Recursion, nested classes,

Inheritance: Inheritance and its types, super, overriding, Abstract Classes, Using final.
Packages And Interfaces: packages, Access protection, Importing packages, Implementing Interfaces

UNIT -III
Exceptional Handling: Exception–handling fundamentals, Exception types, Using try and Catch, throw, throws and finally clauses.

Multithreaded Programming: java Thread Model, Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter thread communication.

UNIT - IV
String Handling: String class, String buffer class, String length, Special String operations, string comparison, Primitive type wrappers

Java I/0 classes and Interfaces, Files, Stream and Byte Classes, Character Streams, Serialization. Deserialization.

UNIT –V
GUI and Event Driven Programming: Applet Class, Event Handling, Delegation event model, event classes, event listener Interfaces.

Using AWT Controls, Layout Managers and Menus: AWT classes, Window fundamentals**,** labels, Buttons, Checkboxes, lists etc, layout managers, Handling Events by extending AWT components.

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Text Books:

1. Patrick Naughton "JAVA, The Complete Reference" Tata McGraw Hill, 4th Edition 2005. (For Unit : I,II,III and IV)
2. Richard A.Johnson, "Java Programming and Object-Oriented Application Development" Cengage Learning, India edition 2009. (For Unit : V)

Suggested Reading:

1. John Dean and Raymond "Introduction Programming with Java A problem solving approach", McGraw Hill 2008.
2. Joe Wigglesworth and Paula McMillan, "Java Programming: Advanced Topics" Cengage Learning. 3rd Edition 2009.

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16MCC107 **COMPUTER ORGANIZATION**

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

Course Objectives:
Students will:
1. Understand the basics of Boolean algebra.
2. Learn the concepts of digital circuits.
3. Understand the various computer micro operations.
4. Acquire the knowledge of computer organization and design.
5. Learn various topics pertaining to the operations of Central Processing Unit.
6. Understand the basic principles of concurrent and parallel processing.

Course Outcomes:
After completion of the course, the students would be able to:
1. Acquainted with the representations of number systems.
2. Understand the concepts of Boolean algebra and KMaps.
3. Learn the basic computer organization and its design.
4. Understand the components of CPU and their functionality.
5. Learn the input–output and memory organization.
6. Understands Parallel processing and its applicability.

UNIT -I
Data Representation: Data types, Complements, Fixed and Floating Point Representation, Other binary codes and error Detection codes.

Digital Logic Circuits: Digital Computers, Logic Gates, Boolean algebra, Map Simplification, Combinational Circuits, Flip Flops, Sequential Circuits.

Digital Components: Integrated Circuits, Decoder, Multiplexers, 'Registers, Shift Registers, Binary counter, Memory unit.

UNIT -II
Register Transfer And Micro Operations: Register Transfer language, Register transfer, Bus and Memory Transfer, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations and Arithmetic logic shift unit.

Basic Computer Organization And Design: Instruction codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycles, Memory Reference Instructions, Input, Output and Interrupts, Design of Accumulator logic.

UNIT -III
Central Processing Unit: Micro programmed Control, Control Memory, Address Sequencing, Micro program Example, Design of Control Unit. General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control.

UNIT -IV
Input–Output And Memory Organization: Peripheral Devices, I/O output interface, Asynchronous data transfer, Modes of transfer, Priority Interrupt, DMA, Input output Processor, Serial Communication. : Memory Hierarchy, Main Memory, Cache Memory.

UNIT -V
Parallel Processing: Trends of Parallel Processing, UniProcessor Architecture, Parallel Processing Mechanism, Multi Programming and Time Sharing, Pipeline Computers, Array Computers, Multi-Processor Systems, Serial Vs Parallel Processing, Parallelism Vs Pipelining.

Text Books:

1. M. Morris Mano, "Computer System Architecture", Pearson Asia/Prentice Hall, 3rd edn.2007. (For Units I,II,III and IV)
2. Kai Hwang and Faye A.Briggs, "Computer Architecture and Parallel Processing" International edn., 1984 (For Unit : V),

Suggested Reading:

1. William Stallings "Computer Organization & Architecture", Pearson Education, Sixth Edition, 2003.

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16MCC108 SOFTWARE ENGINEERING

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

Course Objectives:
Students will:
1. Provide the basic definition and understanding of software engineering.
2. Acquaint the software engineering paradigms.
3. Familiarize with the concepts of software requirement specifications.
4. Understand the software design concepts.
5. Learn the concepts of software testing.

Course Outcomes:
After completion of the course, the students will be able to:
1. Understand the basics of software engineering principles
2. Acquire the knowledge on software development models.
3. Translate the problems into software design models.
4. Acquaint with the basics of software design principles.
5. Understand the basics software testing approaches and strategies.
6. Learn the concepts of software reengineering, reverse engineering and software maintenance activities.

UNIT-I
Introduction to Software Engineering: Software Engineering Challenges, Software Engineering approach, Software Process, Waterfall, Iterative, Prototype, Incremental, Spiral, Models.

UNIT- II
Software Requirement Analysis and specification: Software Requirements, Need for SRS, Problem analysis, Requirements specification, IEEE format of SRS, Function Oriented Design: Design Principles, Module-level concepts, Design notations and specifications

UNIT-III
Structured design methodology, Software Architecture: Role of Software Architecture, Architecture views, Component and Connector view. Risk Engineering - Risk Analysis and Management. RMMI Techniques.

UNIT-IV
Effort & Schedule Estimation, Software Project Estimation, COCOMO, Function Point Analysis. Testing Techniques & Strategies: white box, black box, basis path testing, Unit testing, Integration testing, Validation testing & System Testing

UNIT-V
Software Maintenance, Maintenance activities, Software Reengineering, Reverse Engineering, Forward Engineering, Software configuration management.

Text Books:
1. Roger S, Pressman, "**Software Engineering: A Practitioner's Approach**", 6thddition, Tata Mc Graw Hill, 2010.

Suggested Reading:
1. Pankaj Jalote "**An Integrated Approach to Software Engineering**", 3rd edition, Narosa Publishing House, 2010.

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16MCC109 **DATA STRUCTURES USING C ++**

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

Course Objectives:
Students will:
1. Know the basic concepts of C++.
2. Acquire the knowledge on classes and Inheritance concepts.
3. Aware of different linear data structures concepts.
4. Get the knowledge on different sorting techniques.
5. Understand the concept of hashing and collision resolution techniques.
6. Aware of different non-linear data structures.

Course Outcomes:
After completion of the course, students would be able to:
1. Gain knowledge on basic concepts of C++.
2. Get the knowledge on classes and inheritance concepts.
3. Learn various linear data structures concepts.
4. Distinguish between different sorting techniques.
5. Implements different collision resolution techniques on hashing.
6. Acquire knowledge on various non-linear data structures.

UNIT- I
C++ Introduction: Overview, Program Structure, namespace, identifiers, variables, constants, data types, enum, operators, Overloading of functions, default arguments, this pointer, inline functions, dynamic memory allocation and De allocation (new and delete), operator overloading.

UNIT- II
C++ Class Overview: Class Definition, Objects, Class Members, Access Control, Class Scope, Constructors and destructors, friend functions. Function and class templates, Inheritance basics, base and derived classes, inheritance types, base class access control, overriding, runtime Polymorphism using virtual functions.

UNIT- III
Sparse Matrix: Representation and its efficiency in storage.
Stacks: Definition and Operations and Applications, Array and Linked Representation of Stacks.
Queues: Definition and Operations. Array and Linked Representation of Queues and their Applications.
Linked Lists: Definition and Operations, Double linked list representation, Circular linked lists.

UNIT- IV
Sorting: Bubble sort, Merge Sort, Selection Sort, heap sort, Quick sort, Insertion sort , Posterior Analysis, Sequential Search, binary search.
Hashing : Hash table, its implementation, Hash table representation, types of hashing,collision resolution techniques.

UNIT- V
Trees: Definitions and Properties, Representation of Binary Trees, Operations. Binary Tree Traversal, Binary search trees, operations- insertion, deletion and searching, heap trees. AVL Tress and Operations on AVL Trees.B-Trees and its operations.
Graphs: Definition and representation of graphs, data structures for representing graphs- edge list structures, adjacency list structures, adjacency matrix,Graph traversals – BFS and DFS. Spanning trees, minimum spanning trees, prim’s and kruskal’s algorithms.

Text Books:
1. Object Oriented Programming with C++, E. Balaguru Swamy, Tata McGraw Hill,4th Edition, 2008.
2. Data structures, Algorithms and Applications in C++, S. Sahani, Universities Press. 2nd Edition, 2006.

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Suggested Reading:

1. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI. 2nd Edition, 2002.
2. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and D.Mount, Wiley student edition, seventh edition, John Wiley and Sons, 2011.
3. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, 3rd Edition, Pearson Education. Ltd., 2007.

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16MCC110 **OPERATIONS RESEARCH**

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

Course Objectives:
The students will:
1. Understand and analyze managerial problems in industry to utilize resources effectively.
2. Formulating the mathematical models for real world managerial problems in industry.
3. Minimizing loss and maximizing profit of an organization.
4. Find the shortest paths to the transportation problems.
5. Provide networks and queuing models which are applicable to manage organizational functionalities.
6. Learn techniques to solve linear programming problems using different methods.
7. Solve problems using dynamic programming.

Course Outcomes:
After completion of the course, the students would be able to:
1. Apply the methods to utilize organizational resources effectively.
2. Formulate mathematical models for real world problems.
3. Apply the methods of maximization and minimization to get more profits and reduced losses.
4. Solve linear programming problems.
5. Model and solve the managerial problems using dynamic programming.
6. Apply networks and queuing models to solve organizational problems.

UNIT - I
Linear Programming: Introduction, Concepts of Linear Programming Model, Development of LP models, Graphical Method, Linear Programming Methods, Special cases of Linear Programming, Duality.

UNIT - II
Transportation Problem: Introduction, Mathematical Model for Transportation Problem, Types of Transportation problem, Methods to solve Transportation Problem, Transshipment Model.

UNIT - III
Assignment Problem: Introduction, Zero-One Programming Model for Assignment Problem, Types of Assignment Problem, Hungerian Method, Branch-and-Bound Technique for Assignment Problem.
Network Techniques: Introduction, Shortest path models – Systematic Algorithm, Dijkastras Algorithm, Floyd Algorithm, Minimum Spanning Tree Problems – PRISM, Kruskal's Algorithms.

UNIT - IV
Dynamic Programming: Introduction, Applications of Dynamic Programming, Solution of Linear Programming Problem through Dynamic Programming.

UNIT - V
Game Theory: Introduction, Game with Pure Strategies, Game with Mixed Strategies, Dominance Property, Graphical Method for 2 X n or m x 2 Games, Linear Programming Approach for Game Theory.

Text Books:
1. Panneerselvam "Operations Research", Second Edition, PHI, 2006.

Suggested Reading:
1. Prem Kumar Gupta and DS Hira, "Operations Research", S. Chand, 2011.
2. JK Sharma, "Operations Research Theory and Applications", Fourth Edition, MacMillan, 2010.
3. Rathindra P sen, "Operations Research- Algorithm and Application", PHI, 2010.
4. K.Swarup, P.K. Gupta and Man Mohan "Operations Research" Sultan Chand & Sons, 2012.

16MTC102 **PROBABILITY AND STATISTICS**

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

Course Objectives:

The students will:

1. Extend and formalize knowledge of the theory of probability and random variables.
2. Introduce new techniques for carrying out probability calculations and identifying probability distributions.
3. Motivate the use of statistical inference in practical data analysis.
4. Study the elementary concepts and techniques in statistical methodology.
5. Provide the introduction to subsequent statistics courses.

Course Outcomes:

After completion of the course, the students would be able to:

1. Describe discrete data graphically and compute measures of centrality and dispersion.
2. Compute probabilities by modeling sample spaces and applying rules of permutations and combinations, additive and multiplicative laws and conditional probability
3. Construct the probability distribution of a random variable, based on a real-world situation, and use it to compute expectation and variance.
4. Compute probabilities based on practical situations using the binomial and normal distributions.
5. Use of statistical inference in practical data analysis.

UNIT –I:

Introduction to Statistics: Over view, origin and development of Statistics, Managerial applications of statistics. Methods for collection of data, constructing a graphical methods (Histogram, Ogive curve, Pie-Chart, Stem and Leaf diagram) Measures of Central Tendency, Measures of Dispersion: Skewnes and Kurtosis.

UNIT-II:

Probability and Random Variables - Introduction to Probability: Concepts and Definitions of probability-classical and axiomatic approach. Sampling theorems- Addition theorem, multiplication theorem and conditional probability and Bayes Theorem.

Random variables: Expectation and variance of a random variable, Probability distribution function, properties of discrete and continuous probability distribution functions.

UNIT-III:

Probability distributions- Discrete probability distributions: Binomial distribution, Properties and applications - Poisson distribution, Properties and applications.

Continuous probability distributions: Normal distribution, Standard normal random variable, Properties and applications, Exponential distribution Properties and applications.

UNIT-IV:

Sampling Estimation-Statistical estimation: Point and interval estimation, confidence interval.

Testing of Hypothesis: Steps for statistical testing, Type I and Type II errors. Large sample tests-Test for one and two proportions, Test for one and two means, Test for equality of variances.

UNIT-V:

Hypothesis testing for Small samples and Curve Fitting-Small sample tests: t- distribution- Properties and applications, Testing for one and two means.

Chi-square distribution: Test for goodness of fit, Test for independence of attributes

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Curve fitting: Correlation-Properties, Regression-Lines of Regression-Properties. Fitting of Straight Line and Growth Curves.

Text Books:

1. S.C.Guptha & V.K.Kapoor "Fundamentals of Mathematical Statistics" , Sultan Chand Pub.,2014.
2. S.C.Guptha "Fundamentals of Statistics", Himalaya Publishing, 7th Edition , 2014.

Suggested Reading:

1. A.K. Md. Ehsanes Saleh Vijay K. Rohatgi, "An Introduction to Probability and Statistics", Wiley, 2008.
2. Anthony J. Hayter "Probability and Statistics for Engineers and Scientists", Brooks/Cole; International edition, 4th Revised edition, 2012

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16MCC111 OBJECT ORIENTED PROGRAMMING LAB UISNG JAVA

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

Course Objectives:
Students will be able to:
1. Memorize the object oriented programming concepts.
2. Create classes, objects and constructors.
3. Know the difference of overloading and overriding.
4. Learn the concepts of exception handling and multithreading.
5. Acquire the knowledge on I/O package.
6. Learn the Applets and AWT components.

Course Outcomes:
After completion of the course, students would be able to:
1. Write programs using object oriented programming.
2. Develop classes, objects and constructors.
3. Implement multithreading and exception handling concepts.
4. Create programs on strings and I/O streams.
5. Develop Applets and AWT Components
6. Apply event handling and arrange layout managers.

List of Sample Problems/Experiments:

1. Write programs to perform basic operations (Operators, Control Structures, Arrays etc..)
2. Write a program to create classes, objects
3. Write Programs using constructor
4. Write programs using method overloading
5. Write programs using method overriding, dynamic method dispatch
6. Write Programs using inheritance
7. Write programs on interfaces
8. Write programs on packages
9. Write programs on Exception handling
10. Write programs on Multithreading
11. Write programs using wrapper classes
12. Write Programs using I/O streams and files
13. Write programs on applets
14. Write Programs using AWT
15. Write programs using Event handling, Layout managers

Suggested Reading:

1. Patrick Naughton "Java, the Complete Reference" Tata McGraw Hill 2005.
2. Richard A.Johnson, "Java Programming and Object-Oriented Application Development" Cengage Learning, India edition 2009.

16MCC112 **DATA STRUCTURES LAB USING C++**

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

Course Objectives:
Students will:
1. Know the concepts of classes, constructors and destructors.
2. Acquire the knowledge on inheritance concepts.
3. Aware of different linear data structures concepts.
4. Get the knowledge on different sorting techniques.
5. Understand the concept of hashing and collision resolution techniques.
6. Aware of different non-linear data structures.

Course Outcomes:
After completion of the course, students would be able to:
1. Design classes, constructors and destructors.
2. Implement programs on various inheritance types.
3. Develop programs on various linear data structures.
4. Implement the programs on different sorting techniques.
5. Implements different collision resolution techniques on hashing.
6. Develop programs on various non-linear data structures.

List of Sample Problems/Experiments:
1. Write a C++ program to illustrate the concept of Class with Constructors, Methods.
2. Write a C ++ program to illustrate the concept of Inheritance.
3. Write a C++ programs for implementing Stack using following:
   a) Arrays
   b) Linked Lists
4. Write a C++ programs for implementing Queues using following:
   a) Arrays
   b) Linked Lists
5. Write a C++ programs for implementing Linked Lists:
   a) Single Linked Lists
   b) Double Linked Lists
   c) Circular Linked Lists
6. Write a program for infix to postfix conversion.
7. Write a C++ program for implementing Binary Search Trees.
8. Write a C++ program for implementing Hashing.
9. Write a C++ program for implementing Quick Sort.
10. Write a C++ program for implementing Insertion Sort.
11. Write a C++ program for implementing Selection Sort.
12. Write a C++ program for implementing Merge Sort.
13. Write a C++ program for implementing Graph Traversals DFS and BFS.

Suggested Reading:

1. Complete reference to C++, 4th Edition, Herbert Schildt., 2003.
2. Object Oriented Programming with C++, E. BalaguruSwamy, Tata McGraw Hill, 4th Edition, 2008.
3. Advanced Data structures & Algorithms in C++,V.V.Muniswamy,Jaico Publishing House.
4. Data structures via C++, A.M. Berman, Oxford University Press.

16MCC113 **DATABASE MANAGEMENT SYSTEM**

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

Course Objectives:
Students will:
1. Learn the basic fundamentals of database.
2. Understand the data models.
3. Make a study of SQL and relational database design.
4. Know about data storage techniques and query processing.
5. Impart knowledge in transaction processing, concurrency control techniques.
6. Study the concepts of system crash and recovery management.

Course Outcomes:
After completion of the course the students would be able to:
1. Acquire the knowledge of the basic concepts of the database.
2. Create the data models.
3. Map ER models into Relations and normalize the relations
4. Acquire the knowledge of query evaluation.
5. Gain the knowledge of concurrent execution and transaction management.
6. Understand the issues in system crash and recovery measures.

UNIT-I
Introduction to DBMS and DB Models: File system Vs. DBMS, Advantages of DBMS, Data Abstraction, Database Design, and ER diagrams, Entities, Attributes and Entity Sets, Relationship Sets, Additional features of ER model, Conceptual Design with the ER model. The Relational Model: Introduction to the Relational Model, Integrity Constraints over relations, Logical Database design(ER to Relational), creating tables, views, Destroying / Altering Tables and Views.

UNIT-II
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Normal Forms, Decompositions, Normalizations. **Structured Query Language**: Overviews, Basic Structure of SQL, Queries, Set Operations, Null Values, Additional Basic Operations, Aggregate Functions, Nested Sub queries, Join Expression. **Advanced SQL**: SQL Data Types, Integrity Constraints, Authorization, Functions and Procedural Constructs, Cursors, Triggers.

UNIT-III
Indexing and Hashing: Basic Concepts, File Organization Indexing, Index Data Structures, Tree-Structured indexing: Indexed sequential Access Method (ISAM) B+ Trees: A dynamic index structure, format of a node, search, Insert, Delete, Duplicates+ Trees in Practice.
Hash-Based Indexing: Static Hashing, Extendable Hashing, Linear Hashing, Extendable Hashing versus Linear Hashing. Comparison of Ordered Indexing and Hashing.

UNIT-IV
Transaction Management: ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control. **Concurrency Control**: 2PL, Serializability, and Recoverability, Introduction to Lock Management, Dealing with Deadlock, Specialized Locking Techniques, Concurrency Control without Locking.

UNIT-V
Crash Recovery: Introduction to ARIES, The Log, Other Recovery Related Structures, The WAL, Check pointing, recovering from a system Crash, Media recovery. Security and Authorization: Introduction to database security, Access Control Discretionary Access control, Mandatory access control. Additional Issues related to Security.

Text Books:

1. Silberschataz, Korth, Sudarshan “Database System Concepts”, 5^{th} Edition McGraw Hill 2011.

Suggested Reading:

1. Raghu Ramakrishna, Johannes, Gehrke “Database Management Systems”, 3^{rd} Edition, Mc-Graw Hill 2003
2. Ramez Elmasri, Shamkant B. Navathe, Somayajulu, Gupta “Fundamentals of Database systems”, Pearson Education 2006.

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16MCC114 **WEB TECHNOLOGIES**

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

Course Objectives:
Students will:
1. Acquire knowledge on XHTML and CSS.
2. Learn basics of JavaScript.
3. Know how to create interactive web pages.
4. Acquire knowledge on XML.
5. Learn basics of PHP and MYSQL databases.
6. Acquire knowledge on client side and server side programming.

Course Outcomes:
After completion of the course, the students would be able to:
1. Develop the web pages using XHTML and CSS.
2. Perform client side validations.
3. Create interactive web pages.
4. Store and transport data using XML.
5. Access MYSQL database using PHP.
6. Design and Develop simple websites.

UNIT – I
Introduction to XHTML: origins and evolution of HTML and XHTML, basic syntax, standard XHTML document structure, basic text markup, images, hypertext links, lists, tables, forms, frames, syntactic differences between HTML and XHTML.
Cascading Style Sheets (CSS): Introduction, levels of style sheets, style specification formats, selector forms, property value forms, font properties, list properties, color, alignment of text, box model, background images, positioning.

UNIT – II
Basics of JavaScript: overview of JavaScript, object orientation and JavaScript, general syntactic characteristics, primitives, operations, expressions, screen output and keyboard input, control statements, object creation and modification, arrays, functions, constructors, pattern matching using regular expressions, errors in scripts.

UNIT- III
JavaScript and XHTML Documents: JavaScript execution environment, document object model, element access in JavaScript, events and event handling, handling events from body elements, handling events from button elements, Handling events from text box and password elements.
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 – IV
Introduction to XML: Introduction, syntax of XML, XML document structure, document type definitions, namespaces, XML schemas, displaying raw XML documents, displaying XML documents with CSS, XSLT style sheets, XML processors.

UNIT – V
Introduction to PHP: origins and uses of PHP, overview of PHP, general syntactic characteristics, primitives, operations, expressions, output, control statements, arrays, functions, pattern matching, form handling, cookies, session tracking.
Database Access through the web: MYSQL database system, database access with PHP and MYSQL.

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Text Book:

1. Robert W.Sebesta, “**Programming the World Wide Web**”, 4^{th} Edition, Pearson Education, 2008.

Suggested Reading:

1. Thomas Powell “HTML & XHTML: The Complete Reference”, 4^{th} Edition, Tata McGraw-Hill, 2003.
2. Thomas A Powell, Fritz Schneider “JavaScript: The Complete Reference”, 3^{rd} edition, Tata McGraw Hill, 2013.
3. Steven Holzner “PHP: The Complete Reference”, McGraw Hill Education, 2008.

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16MCC115 DESIGN AND ANALYSIS OF ALGORITMS

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

Course Objectives:

Students will:

1. Learn the various asymptotic notations and amortized analysis.
2. Acquire knowledge on divide and conquer and Greedy designing techniques.
3. Learn the concepts of dynamic programming techniques.
4. Acquire knowledge on backtracking and branch and bound designing techniques.
5. Learn the concepts of NP-Hard and NP-completeness.
6. Learn important algorithmic design paradigms and methods of analysis.

Course Outcomes:

After completion of the course, the students would be able to:

1. Analyze the time and space complexities of algorithms.
2. Solve various problems using divide and conquer and greedy method.
3. Solve various problems using dynamic programming, backtracking and branch and bound techniques.
4. Identify the complexity classes such as P, NP, NP-Complete and NP-Hard to which an algorithm belongs and design a feasible solution.
5. Determine the amortized running time of the problem.

UNIT-I

Introduction: Algorithm Definition, Algorithm Specification, Performance Analysis.

Review of Elementary Data Structures: Stacks, Queues, Trees, Dictionaries, Priority Queues, Sets and Disjoint Set Union.

UNIT-II

Divide and Conquer: General Method, Finding the Maximum and Minimum, Merge Sort, Quick Sort, Stassen's Matrix Multiplication.

Greedy Method: General method**,** Knapsack problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees, Optimal Storage on Tapes, Optimal Merge Patterns.

UNIT-III

Dynamic Programming: General Method, Multistage Graphs, All-Pairs Shortest Paths, Optimal Binary Search Trees, 0/1 Knapsack, Reliability Design, Traveling Salesmen Problem.

Basic Traversal and Search Techniques: Breadth First Search (DFS) and Traversal, Depth First Search (DFS) and Traversal, Connected Components and Spanning Trees, Bi-connected Components and DFS.

UNIT-IV

Backtracking: General Method, 8-Queen's Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles, Knapsack Problem.

Branch and Bound: The Method, 0/1 Knapsack Problem, Traveling Salesperson Problem.

UNIT -V

NP-Hard and NP-Complete Problems: Basic Concepts, Cook's Theorem, NP-Hard Graph Problems and NP-Hard Scheduling Problems.

Text Book:

1. Ellis Horowitz, Sartaj Shani, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, University Press, 2007.

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Suggested Reading:

1. R. Pannerselvam “Design and Analysis of Algorithms”, PHI, 2007.
2. Hari Mohan Pandey "Design and Analysis of Algorithms", University Science Press, 2009.
3. Aho, Hopcroft, Ullman “The Design and Analysis of Computer Algorithms”, Pearson Education, 2000.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein “Introduction to Algorithms”, 2^{nd}Edition, Prentice Hall of India Private Limited, 2006.
5. Anany Levitin “Introduction to the Design & Analysis of Algorithms”, Pearson Education, 2003.
6. Parag H.Dave, Himanshu B. Dave “Design and Analysis of Algorithms”, Pearson Education, 2^{nd} Edition, 2014.

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16MCC116 **OPERATING SYSTEMS**

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

Course Objectives:

Students will:

1. Aware of the evolution and fundamental principles of operating system, processes and their communication.
2. Aware of the process execution in terms of threads and they came to know about different thread libraries.
3. Aware of the various process synchronization tools and they came to know about dead lock and its issues.
4. Aware of the various operating system components like process management, memory management.
5. Know about file management and I/O subsystems concepts in operating systems.
6. Aware of components of operating system in LINUX with relevant case study.

Course Outcomes:

After completion of the course the students would be able to:

1. Get the knowledge of operating system components and its services.
2. Understand the basic process execution in terms of threads and they came to know about different thread libraries.
3. Learn the various process synchronization tools and they came to know about dead lock and its issues.
4. Distinguish the mapping between the physical memory and virtual memory.
5. Apply file handling concepts in OS perspective.
6. Acquire the knowledge of components and services of LINUX Operating System.

UNIT-I

Operating System Introduction: Operating Systems Objectives and functions, Computer System Architecture, OS Structure, OS Operations, Evolution of Operating Systems - Simple Batch, Multi programmed, time shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, Special - Purpose Systems**.**

System structures: Operating System Services, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, Operating System Structure, Virtual Machines, Operating System debugging.

Process Concept: Process Concept, Process Scheduling, Operations on process, Inter process Communication.

Multithreaded Programming: Multithreading Models, Thread Libraries, Threading Issues.

UNIT–II

Process Scheduling: Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple Processor Scheduling.

Process Synchronization: Critical Section Problem, Peterson's Solution, Semaphores, Classic Problems of Synchronization, Monitors.

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

UNIT- III

Memory Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation.

Virtual Memory Management: Demand Paging, Copy on Write, Page Replacement Algorithms, Allocation of Frames, Thrashing.

System Protection: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix.

UNIT- IV

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

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

Secondary Storage Structure: Overview of Mass Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap Space Management, RAID Structure.

UNIT- V

I/O Systems: I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Request to Hardware Operations, STREAMS.

Case Study: **The Linux System**: Linux History, Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Input and Output, Inter process Communication.

Text Book:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", 7th Edition, John Wiley and Sons, 2011.
2.

Suggested Reading:

1. Gary Nutt, "Operating Systems", 3rd Edition, Pearson Education, 2004.
2. Harvey M. Deital, "Operating Systems", 3rd Edition, Pearson Education, 2004.

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16MCC117 DATABASE MANAGEMENT SYSTEMS LAB

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

Course Objectives:
Students will:
1. Present SQL and procedural interfaces to SQL comprehensively.
2. Give an introduction integrity constraints on a database using a state-of-the-art RDBMS
3. Understand the concepts of Views and their usability.
4. Impart the knowledge PL/ SQL including stored procedures, stored functions, cursors, packages
5. Understand the Data Control Language (DCL) privileges and roles.
6. Present the concepts of Forms and Reports

Course Outcomes:
After completion of the course, the students would be able to:
1. Populate and query a database using SQL DML/DDL commands.
2. Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS
3. Implement the views with multiple options.
4. Programming PL/SQL including stored procedures, stored functions, cursors, packages.
5. Access and control authorization.
6. Design and build a Forms and Reports

List of Programs:

I. SQL
1. Creating tables using commands in DDL
2. Manipulating the data using DML
3. Using Aggregate functions Set operators
4. Simple condition query creation using SQL Plus
5. Complex condition query creation using SQL Plus
6. Exercising all types of Joins, views
7. Exercising Data Control Language and Transaction Control Language

II. PL/SQL
8. Demonstration of Blocks, Cursors,
9. Procedures, Functions and Packages.
10. Creation of Triggers

III. FORMS
11. Designing forms for various databases.(Creating, Inserting, Updating, Deleting)

IV. REPORTS
12. Generation using SQL Reports
13. Creation of Reports based on different queries.

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

Suggested Reading:

1. Nilesh Shah "**Database Systems Using Oracle**", PHI, 2007.
2. Rick F Van der Lans "**Introduction to SQL**", 4th Edition, Pearson Education, 2007.
3. Benjamin Rosenzweig, Elena Silvestrova "**Oracle PL/SQL by Example**", 3rd Edition, Pearson Education, 2004.
4. Albert Lulushi "**Oracle Forms Developer's Handbook**", Pearson Education, 2006.

16MCC118 **WEB TECHNOLOGIES LAB**

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

Course Objectives:
Students will:

1. Practice various tags in XHTML and CSS.
2. Practice programs using JavaScript control statements, arrays, functions etc.
3. Practice programs using events on the XHTML elements.
4. Practice programs using XML.
5. Practice programs using PHP control statements, arrays, functions etc.
6. Practice programs using MYSQL database.

Course Outcomes:
After completion of the course, the students would be able to:

1. Create static web pages using XHTML and CSS.
2. Create dynamic web pages and perform client side validations using JavaScript.
3. Store and Transport data using XML.
4. Write programs using PHP.
5. Access MYSQL database through PHP.
6. Design and Develop websites.

List of programs:

XHTML: Create programs using the following concepts

1. Text Markup Tags.
2. Images.
3. Hyperlinks.
4. Ordered and Unordered Lists.
5. Tables and Nested Tables.
6. Forms.
7. Frames.

CSS: Create programs using the following concepts

8. Inline Styles.
9. Internal Stylesheet.
10. External Stylesheet.
11. Pseudo Classes.
12. Font properties. Borders, Margins, Paddings and Background Images.

JAVASCRIPT: Create programs using the following concepts

13. Pre-defined objects (Date, String, Math etc.,).
14. Selection statements switch statements and loop statements.
15. Demonstrate user defined objects.
16. Array object.
17. Functions.
18. Illustrate pattern matching using regular expressions.
19. Handle various events occurred in the HTML document.
20. Validate the form data.
21. Illustrate positioning of the HTML elements in the web page.
22. Demonstrate moving elements, elements visibility, stacking elements and dragging and dropping elements.

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XML: Create programs using the following concepts

24. XML Documents.
25. XML Schema for the XML documents.
26. CSS style sheets for the XML documents.
27. XSLT style sheet for the XML documents.
28. Design an XML document to store information about patients in a hospital.

PHP: Create programs using the following concepts

29. Selection statements and loop statements.
30. Arrays.
31. Functions.
32. Pattern matching.
33. Handling forms.
34. Access MYSQL database through PHP.

Suggested Reading:

1. Robert W.Sebesta "**Programming the World Wide Web**", 4th Edition, Pearson Education, 2008.
2. Thomas Powell "**HTML & XHTML: The Complete Reference**", 4th Edition, Tata McGraw-Hill, 2003.
3. Thomas A Powell, Fritz Schneider "**JavaScript: The Complete Reference**", 3rd Edition, Tata McGraw Hill, 2013.
4. Steven Holzner "**PHP: The Complete Reference**", McGraw Hill Education, 2008.

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16MCC119 **OPERATING SYSTEMS LAB**

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

Course Objectives:
Students will:
1. Learn programs on system calls, threads and signals
2. Learn programs on process scheduling algorithms
3. Learn programs on Inter process Communication.
4. Learn programs on synchronization problems
5. Learn programs on files
6. Learn about the basic Linux commands.
7. Learn basic shell programs.

Course Outcomes:
After completion of the course, the students would be able to:
1. Write programs on system calls, threads and signals.
2. Write programs on process scheduling algorithms
3. Write programs on Inter process Communication.
4. Write programs on synchronization problems
5. Write programs on files
6. Use basic Linux commands
7. Write basic shell programs

List of Programs:

1. Programs using process related systems calls.
2. Print type of file for each command line arguments.
3. Programs to create threads.
4. Program using Signals.
5. Programs on process scheduling algorithms
6. Echo server-using pipes.
7. Echo server-using message Queues.
8. Producer & Consumer Problem using Semaphores and Shared memory
9. Producer & Consumer Problem using message passing.
10. Readers & Writers Problem using Semaphores and Shared memory
11. Dining philosopher's problem using semaphores.
12. Programs related to files
13. Program using File Locking.
14. Basic Linux Commands
15. Basic shell scripts

Suggested Reading:

1. W. Richard Stevens, "**Unix Network Programming**", Pearson Education Inc, PHI Learning 1990.
2. Behrouz A. Forouzan, Richard F. Gilberg, "**UNIX and Shell Programming: A Textbook**", Books/Cole-Thomson Learning, 2003.

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16MBC04 ORGANIZATIONAL BEHAVIOUR (Open Elective)

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:
1. Familiarize the students with the basic understanding of individual behavior and explore issues of motivation, communication, leadership, power, politics and organizational change.
2. Provide a comprehensive, up-to-date, practical knowledge base that provides an engaging introduction and concepts of organizational behavior.
3. Orient the students with real life examples that correlate the theory to actual practice from the industry.
4. Enable the students to practically implement the Organizational Behavior principles and practice in real time situations in their careers and life.

Course Outcomes:
After completion of this course students would be able to:
1. Analyze the behavior, perception and personality of individuals and groups in organizations in terms of the key factors that influence organizational behavior.
2. Assess the potential effects of organizational-level factors on organizational behavior.
3. Critically evaluate the potential effects of motivating and leading the individuals in the Organization.
4. Analyze organizational behavioral issues in the context of groups, power, politics and conflict issues.

UNIT – I
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
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–early and contemporary theories of motivation. Leadership – early and contemporary approaches to leadership.

UNIT – IV
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–Sources of individual, functional and divisional Power. Organizational politics. Conflict – causes and consequences – Pondy's model of organizational conflict–conflict resolution strategies.

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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) Ltd., 2001.
3. Richard Pettinger "Organizational Behaviour", Routledge, 2010

Suggested Reading:

1. Stephen P. Robbins, Jennifer George and Gareth Jones "Management and Organizational Behavior", 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 Behavior", 10^{th} Edition, Wiley India, Edition. 2009.

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16CEE21 DISASTER MITIGATION AND MANAGEMENT (Open Elective)

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:
1. Equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. Impart knowledge in students about the nature, mechanism causes, consequences and mitigation measures of the various natural disasters including hydro metrological and geological based disasters.
3. Enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters including chemical, biological and nuclear warfare agents.
4. Equip the students with the knowledge of various chronological phases in the disaster management cycle.
5. Create awareness about the disaster management framework and legislations in the context of national and global conventions.
6. 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, students would be able to:
1. Analyze 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 "Disaster Management Global Challenges and Local Solutions", Universities Press Hyderabad, R.R ,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.
2. Fearn-Banks "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.

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16MCC120 **COMPUTER NETWORKS**

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

Course Objectives:

Students will:

1. Learn the basics of data communication and networks.
2. Get the idea of different layers of OSI model.
3. Learn the concepts of Data Link layer such as Flow and Error control.
4. Study various Routing Algorithms and concepts of Network layers.
5. Learn Transport layer protocols and concepts of Application layer.
6. Obtain the concepts of Socket programming.

Course Outcomes:

After completion of the course, the students would be able to:

1. Gain good knowledge of the basics of data communication and networks.
2. Get an overview of the different layers of OSI model.
3. Gain knowledge of Flow and Error control mechanisms of Data Link layer.
4. Design various Routing Algorithms of Network layer.
5. Formulate Transport layer protocols and concepts of Application layer.
6. Acquire the knowledge of Socket programming.

UNIT - I

Data Communications: Components – Data Representation - Data Flow, Networks- Network Criteria – Physical Structure- Network Models – Categories of Networks – Internetwork, Internet, Protocols and Standards, Network models - ISO/OSI model and its layers, TCP/IP model, Addressing, Physical layer and Media – Digital to Digital conversion, Line coding, Transmission modes, Transmission Media- Guided media – Unguided media, Modem, RS232 Interfacing.

UNIT-II

Data link Layer: Error detection and Correction – Block coding, Hamming code, CRC, Flow and Error control, Noiseless channels - Simple and Stop and Wait protocols, Noisy channels-Stop and Wait ARQ – Go back-N ARQ – Selective repeat ARQ – Piggybacking, HDLC.

Multiple Access: LAN-Pure and Slotted ALOHA, Ethernet IEE 802.3, IEEE 802.4,IEEE 802.5, Bridges.

UNIT-III

Network Layer- Internetworks - Switching– Virtual Circuit and Datagram Network concepts, Logical Addressing, Internet Protocol. Routing – Unicast Routing Protocols - Distance Vector Routing, RIP, Link State Routing, OSPF, Path Vector Routing, BGP.

UNIT-IV

Transport Layer: Services of Transport Layer, Multiplexing.

Transmission Control Protocol (TCP) – Congestion control and Quality of Services - User Datagram Protocol (UDP).

Application Layer: Domain Name Space (DNS), SMTP and FTP, WWW and HTTP, Fire Walls.

UNIT-V

Socket Programming: Socket address, elementary socket system calls, advanced socket system calls, reserved ports, socket option, asynchronous I/O input/output Multiplexing out-of-band data, sockets and signals, Internet super server.

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Text Books:

1. Behroz A Forouzan, “Data Communications and Networking”, 4^{th} Edition, Tata McGraw – Hill, 2009.
2. W. Richard Stevens, “Unix Network Programming”, Pearson Education Inc, PHI Learning 1990.

Suggested Reading:

1. Andrew S. Tanenbaum, “Computer Networks”, 5^{th} Edition, Pearson Education, 2011.

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16MCC121 **DATA WAREHOUSING AND DATA MINING**

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

Course Objectives:
Students will:
1. Identify the scope and necessity of Data Mining & Warehousing for the society.
2. Describe and designing of Data Warehousing to integrate the Data Mining system
3. Understand Data Mining functionalities to solve the real world problems.
4. Develop ability to design various algorithms based on data mining techniques.
5. Understand various interesting patterns and presentation techniques for decision making
6. Gain the interest in research and design of new Data Mining Techniques.

Course Outcomes:
After completion of the course, the students would be able to:
1. Identify the scope of Data Mining & Warehousing for the society.
2. Design of Data Warehouses and integrate the Data Mining system for various organizations.
3. Apply Data Mining functionalities to solve the real world problems
4. Design and implement the various data mining algorithms based on various requirements
5. Identify interesting patterns and presentation techniques in making decisions
6. Make base for further research on advanced Data Mining Techniques

UNIT-I:
Introduction: What Motivated Data Mining? Why Is It Important, What Is Data Mining, Data Mining—On What Kind of Data, Data Mining Functionalities—What Kinds of Patterns Can Be Mined?, Are All of the Patterns Interesting? Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or Data Warehouse System, Major Issues in Data Mining,. Data Preprocessing: Why Preprocess the Data, Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

UNIT-II:
DataWarehouse and OLAP Technology: What Is a DataWarehouse, A Multidimensional Data Model, DataWarehouse Architecture, DataWarehouse Implementation, From DataWarehousing to Data Mining, Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction—An Alternative Method for Data Generalization and Concept Description.

UNIT-III:
Mining Frequent Patterns, Associations, and Correlations: Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Mining Various Kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining,

UNIT-IV:
Classification and Prediction: What Is Classification? What Is Prediction, Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Classification by Association Rule Analysis, Lazy Learners, Other Classification Methods, Prediction Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor, Ensemble Methods—Increasing the Accuracy, Model Selection.

UNIT-V
Cluster Analysis: What Is Cluster Analysis, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based

Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis.

Text Books:

1. Jaiwei Han and Micheline Kamber “Data Mining- Concepts and Techniques”, Morgan and Kaufmann, 2nd Edition, 2006.

Suggested Reading:

1. Pang-Ning Tan,Micheal Steinbach, Vipin Kumar, “Introduction to data Mining”, Pearson Education, 2008.
2. Ian. H. Witten, Eibe Frank and Mark.A.Hall “Data Mining:Practical Machine Learning Tools and Techniques”, 3rd Edition(Then Morgan Kufmann series in Data Management systems), 2011
3. “Statistical and Machine learning –Learning Data Mining, Techniques for Better Predictive Modeling and Analysis to Big Data”.
4. Arun K Pujari “Data Mining Techniques”, University Press, 2nd Edition, 2009
5. MH Dunham “Data Mining” Pearson Education, 2009.

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16MCC122 **ADVANCED JAVA PROGRAMMING**

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

Course Objectives:
Students will:
1. Servlets, session management and usage of JDBC in servlets.
2. Java beans, Application builder tool and java beans API.
3. EJB Architecture, EJB requirements and EJB entity beans.
4. EJB clients, deployment tips and perl control structures and operators.
5. JSP scripting elements & directives and java messaging services.
6. JDBC driver connection to database, Row set object and Result set.

Course Outcomes:
After completion of the course, the students would be able to:
1. Get the knowledge of servlets, session management and usage of JDBC in servlets.
2. Employ the java beans, Application builder tool and java beans API.
3. Demonstrate the EJB Architecture, EJB requirements and EJB entity beans.
4. Demonstrate the EJB clients, deployment tips and perl control structures and operators.
5. Identify the JSP scripting elements & directives and java messaging services.
6. Examine the JDBC driver connection to database, Row set object and Result set

UNIT - I
J2EE Platform: Enterprise Architecture Styles, Containers and Technologies.
Servlet overview: The Java web server – your first servlet – servlet chaining – server side includes- Session management – security – HTML forms – using JDBC in servlets – applet to servlet communication.

UNIT - II
Java Beans: The software component assembly model- The java beans development kit- developing beans – notable beans – using infobus - Glasgow developments - Application Builder tool- JAR files-Introspection-Bound Properties-Persistence-customizers - java beans API.

UNIT - III
EJB: EJB architecture- EJB requirements – design and implementation – EJB session beans- EJB entity beans-EJB Clients – deployment tips, tricks and traps for building distributed and other systems – implementation and future directions of EJB-Variable in perl- perl control structures and operators – functions and scope.

UNIT - IV
JSP: Introduction JSP-Examining MVC and JSP -JSP scripting elements & directives-Working with variables scopes-Error Pages - using Java Beans in JSP Working with Java Mail-Understanding Protocols in Javamail-Components-Javamail API-Integrating into J2EE-Understanding Java Messaging Services-Transactions.

UNIT – V
JDBC : Introduction to JDBC, JDBC Drivers, Packages related to JDBC, JDBC Data Sources, Retrieving Meta Information from database and Result set, Distributed Transactions and Row Set objects, Accessing a Database through Servlets and JDBC.

Text Books:
1. H. Schildt, 2002 “Java 2 Complete Reference”, 5th Edition, Tata McGraw Hill, New Delhi.
2. Subramanyan AllamRaju “Professional Java Server Programming”, J2EE 1.3 Edition, A Press Publications.

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Suggested Reading:

1. K. Moss "Java Servlets", 2nd Edition, Tata McGraw Hill, New Delhi, 1999.
2. Joseph O'Neil "Java Beans from the Ground Up", Tata McGraw Hill, New Delhi, 1998.
3. J. McGovern,R. Adatia,Y. Fain, "J2EE 1.4 Bible", Wiley-Dreamtech India Pvt. Ltd, New Delhi, 2003.

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16MCC123 **COMPUTER NETWORKS LAB**

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

Course Objectives:
Students will:
1. Learn Networking commands.
2. Understand connection oriented and connection less iterative programs
3. Learn connection oriented and connection less concurrent programs.
4. Acquire the knowledge of Pre fork Server program.
5. Obtain the concept of Remote command execution.
6. Gain the knowledge of Advanced Socket System Calls.

Course Outcomes:
After completion of the course, the students would be able to:
1. Use Networking commands.
2. Implement connection oriented and connection less iterative programs.
3. Execute connection oriented and connection less concurrent programs.
4. Implement the Pre fork Server program.
5. Run the program on Remote command execution.
6. Execute programs on Advanced Socket System Calls.

List of Programs:

1. Using and understanding following Commands. Ifconfig, net stat, ping, arp, telnet, ftp, finger.
2. a) Connection oriented Iterative Echo Server
   b) Connectionless Iterative Echo server
3. a) Connection oriented Concurrent Echo Server
   b) Connectionless Concurrent Echo server
4. a) Connection oriented Iterative Time Server
   b) Connectionless Iterative Time Server
5. a) Connection oriented Concurrent Time Server
   b) Connectionless Concurrent Time Server
6. Remote command execution.
7. Program to pass file descriptors.
8. To demonstrate the usage of Advanced Socket System Calls like
   Getsockopt(), Setsockopt(), Select(), Readv(), getpeernamet(), Getsockname().
9. To demonstrate the Non-Blocking (Asynchronous) Input-Output.
10. To demonstrate the implementation of Pre forked Server.

Suggested Reading:

1. W. Richard Stevens, “Unix Network Programming”, Pearson Education Inc, PHI Learning 1990.
2. Behroz A Forouzan, “Data Communications and Networking”, 4th Edition, Tata McGraw – Hill, 2009.

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16MCC124 DATA WAREHOUSING AND DATA MINING LAB

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

Course Objectives:
Students will:

1. Understand the need of Data Warehouses over Databases, and the difference between usage of operational and historical data repositories.
2. Understand loading the data from different sources and preprocessing of different types of the data.
3. Build different types of data models from various datasets which are useful to model the data
4. Experience row and column operations of different datasets.
5. Get a clear idea of various classes of Data Mining techniques, their need, scenarios (situations) and scope of their applicability.
6. Learn the algorithms used for various types of Data Mining Problems.

Course Outcomes:
After completion of the course, the students would be able to:

1. Understand the need of Data Warehouses over Databases.
2. Load the data from different sources and preprocess of different types of the data.
3. Build variety of data models useful in modeling data.
4. Use data mining functionalities in different Scenarios.
5. Prepare graphs using data mining tools for patterns presentation.
6. Execute variety of algorithms.

List of Programs:

1. Connect and load data from Databases, User input, Excel files
2. Select the records from data sets using “Select” operation.
3. Extract samples from different data sets using “Selection” operation.
4. Demonstrate of record operation “balance” on different datasets.
5. Aggregate the records using Aggregate operation on different datasets
6. Manage the records of different datasets using “Sort” operation.
7. Merge the records from different datasets.
8. Separate the top most records using “Distinct” operation.
9. Demonstration of record operation “Distinct” on different datasets
10. Filter the fields from different datasets.
11. Derive a new field using existing fields from different datasets using “Derive” operation.
12. Demonstration of field operation “Derive” on different data sets
13. Group the data into different bins using binning.
14. Partition the data using field operation portioning.
15. Interchange the rows and columns of dataset using transpose operation.
16. Draw the graph of “Plot” Graph building on variety of data
17. Draw the graph of “Distribution” Graph building on variety of data
18. Construct histogram on variety of data.
19. Construct collection graph on variety of data.
20. Draw the graph of “Multi plot” Graph building on variety of data
21. Create “Web” Graph on variety of dat.
22. Build Apiori association model on transactional data.
23. Build C4.5 classifier.
24. Train and Test CRT classifier on categorical data.
25. Train and Test CHAID classifier.
26. Construct and Test QUEST classifier.
27. Design, Model and test Neural Network classifier.
28. Construct Binary classifier for binary class data.
29. Construct and Test K-Means clustering model.
30. Model COHENON unsupervised data.

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31. Construct GRI classifier.
32. Construct different REGRESSION equations.
33. Design and Test Logistic modeling.
34. Demonstration of output operations
    a) Stats b) Analysis, c) Matrix, d) Table, e) Transform

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16MCC125 **MINI PROJECTS**

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

Course Objectives:
Students will:

1. Handle small scale projects in the lab.
2. Learn the basic concepts of Front End, Middleware and Back End technologies.
3. Learn the implementation of Mini Project which shall lead into the implementation of Major Project.

Course Outcomes:
After completion of the Mini Project, the students would be able to:

1. Implement the basic level technologies pertaining to Front End, Middleware and Back End.
2. Implement the Major Project successfully.

Fourth Semester of the MCA course contains the Mini Project has to be carried out by each student individually in a period of 15 weeks of duration. Students should submit a synopsis at the end of 2nd week in consultation with the Project Guide. The synopsis should consist of definition of the problem, scope of the problem and plan of action. Before completion of the fourth semester the students are required to present their work before the internal committee of the MCA department, in which each student will be awarded with marks.

At the end of the semester the students are required to present their project work before the External Committee for Vive-Voce examination, in which each student will be awarded with marks.

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16MCE102 **SOFTWARE TESTING (Elective-I)**

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:
1. Learn the basic concepts of Testing.
2. Follow the methodology of White Box Testing.
3. Learn the concepts of Functional Testing.
4. Obtain knowledge of Integration and System Tastings.
5. Understand the concepts of Object Oriented Testing.
6. Obtain the concepts Millennium Testing.

Course Outcomes:
After completion of the course, the students would be able to:
1. Gain the basic knowledge of Testing.
2. Acquire the knowledge of White Box Testing methods.
3. Test an application using Functional Testing.
4. Gain knowledge about Integration and System Testing.
5. Use Object Oriented Testing and Millennium Testing methods.
6. Explore on testing types which are to be applied for various applications.

UNIT-I
Introduction to Software Testing Concepts, White Box Approach, Basis Path Testing, Cyclomatic Complexity, Independent paths, D-D Graphs, Dataflow Testing,

UNIT-II
Functional Testing: Boundary Value Testing, Equivalence Class Testing, Decision Table-Based Testing, Retrospective on Functional Testing.

UNIT-III
Integration and System Testing: Levels of Testing, Unit testing, Integration Testing, System Testing, Interaction Testing.

UNIT-IV
Object-Oriented Testing: Issues in Object-Oriented Testing, Class Testing, GUI Testing, Object-Oriented System Testing.

UNIT-V
Millennium Testing: Exploratory Testing, Model-Based Testing, Test-Driven Development, All Pairs Testing, Software Testing Excellence.

Text Books:
1. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", 3rd Edition, CRC Press, 2007.
2. Roger S. Pressman "Software Engineering", 7th Edition, Pearson Education.

Suggested Reading:
1. Boris Beizer "Software Testing Techniques", 2nd Edition, Dreamtech, 2013.
2. M.G. Limaye "Software Testing: Principles – Techniques and Tools", 1st Edition, Tata Mc. Hill, 2009
3. Mauro Pezze, Michal Young "Software Testing and Analysis: Process, Principles and Techniques", Wiley India Pvt. Ltd.

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16MCE103 **ARTIFICIAL NEURAL NETWORKS (Elective-I)**

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:

1. Basics of Biological Neural Networks.
2. Basics of Artificial Neural Networks.
3. Applications of Artificial Neural Networks.
4. Different pattern recognition tasks using Artificial Neural Networks.
5. Competitive learning neural networks.
6. ART networks.

Course Outcomes: After completion of the course, the students would be able to:

1. Gain the knowledge of ANN techniques and their applications.
2. Understand the various algorithms for ANN.
3. Apply various algorithms for ANN.
4. Understand the clustering concepts and algorithms
5. Bring out structural ART networks and feature extraction techniques.
6. Identify, Analyze, Formulate and solve different application oriented problems.

UNIT – I

Introduction to ANN - Features, structure and working of Biological Neural Network Trends in Computing Comparison of BNN and ANN.

Basics of Artificial Neural Networks - History of neural network research, characteristics of neural networks terminology, models of neuron Mc Culloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture

UNIT – II

Backpropagation networks (BPN) - Architecture of feed forward network, single layer ANN, multilayer perceptron, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning.

Activation & Synaptic Dynamics - Introduction, Activation Dynamics models, synaptic Dynamics models, stability and convergence, recall in neural networks.

UNIT – III

Basic functional units of ANN for pattern recognition tasks - Basic feedforward, Basic feed back and basic competitive learning neural network. Pattern association, pattern classification and pattern mapping tasks. Feedforward neural networks – Linear responsibility X-OR problem and solution.

- Analysis of pattern mapping networks summary of basic gradient search methods.

Feedback neural networks Pattern storage networks, stochastic networks and simulated annealing, Boltzmann machine and Boltzmann learning.

UNIT – IV

Competitive learning neural networks - Components of CL network pattern clustering and feature mapping network, ART networks, Features of ART models, character recognition using ART network.

UNIT – V

Applications of ANN - Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters.

NET Talk - to convert English text to speech. Recognition of consonant vowel (CV) segments, texture classification and segmentation.

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Text Books:

1. B. Yegnanarayana “Artificial Neural Networks”, PHI, 2010.
2. S. Raj Sekaran , Vijayalakshmi Pari “Neural networks, Fuzzy logic and Genetic Algorithms”, 2015.

Suggested Reading:

1. Simon Hhaykin “Neural Networks A comprehensive Foundations”, Pearson Education, 2^{nd} Edition 2004.
2. Li Min Fu “Neural Networks in Computer Intelligence”, TMH 2003.
3. James A Feeman David M S Kapura “Neural Networks”, Pearson Education 2004.

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16MCE106 **CLOUD COMPUTING (ELECTIVE-II)**

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:
1. Analyze the components of cloud computing and its business perspective.
2. Evaluate the various cloud development tools.
3. Collaborate with real time cloud services.
4. Analyze the case studies to derive the best practice model to apply when developing and deploying cloud based applications.
5. Understand large data processing in the cloud.
6. Utilize the resource management in the cloud.

Course Outcomes:
After completion of the course, the student would be able to:
1. Identify the components of cloud computing for service perspective.
2. Apply the Cloud Computing developing tools.
3. Imply the Cloud Computing models for developing best applications.
4. Give services in Real time requirements.
5. Apply large data processing methods in Clouds.
6. Use the maximum Cloud Computing resources properly.

UNIT-I
Fundamental Cloud Computing-Understanding Cloud Computing, Origins influences, Basic Concepts and Terminology, Goals, Benefits, risks, Challenges, Rolls and boundaries, Cloud characteristics, Cloud Delivery models, Cloud deployment models.

UNIT-II
Cloud enabling technology-Broadband Networks and Internet architecture, Data center technology, Visualization technology, Cloud Security-basic terms and concepts, Threat agents, Cloud security threats,

UNIT-III
Cloud Infrastructure Mechanisms-Logical network perimeter, Virtual server, Cloud Storage device, cloud usage monitor, Resource replication, special cloud mechanisms, cloud management mechanisms, cloud security mechanisms,

UNIT-IV
Cloud Computing Architecture-Fundamental Architecture, Work load distribution architecture, Resource pooling architecture, Dynamic scalability architecture, service load balancing architecture, Cloud bursting architecture, redundant storage architecture, Hyper clustering architecture, load balanced virtual server instances architecture, non-disruptive service architecture, zero down time architecture, cloud balancing architecture, Resource reservation architecture, rapid provision architecture.

UNIT-V
Working with clouds-(Cloud Provider Perspective) Building IaaS Environments, Equipping PaaS Environment, optimizing SaaS Environments. (Cloud consumer perspective)- Working with IaaS Environments, working with PaaS Environment, working with SaaS Environments.

Text Book:

1. Thomas Erl, Ricardo Puttini "Cloud Computing: Concepts, Technology & Architecture", Prentice, Hall, 1st Edn. 2015

Suggested Reading:

1. Rajkumar Buyya, James Broberge and Anddrzej, M Gosciniski "Cloud Computing Principles and Paradims". Wiley publishing 2011.
2. John W Rittinghouse,james F.Ransome. "Cloud Computing Implementation, Management and Security" CRC Press 2009.
3. Kai Hwang. Geoffrey C.Fox,Jack J. Dongarra, "Distributed and Cloud Computing from parallel Processing to the Internet of things".

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16MCE107 SOFTWARE PROJECT MANAGEMENT (ELECTIVE-II)

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:
1. Introduce software project management and to describe its distinctive characteristics.
2. Discuss project planning and the planning process.
3. Show how graphical schedule representations are used by project management.
4. Discuss the notion of risks and the risk management process.
5. Managing the people in software industry.
6. Understand the quality of a project.

Course Outcomes: After completion of the course, the students would be able to:
1. Gain basic knowledge of software project management principles
2. Come up with a project schedule and assign resources
3. Choose an appropriate project development model.
4. Identify project risks, monitor and track project deadlines.
5. Work in a team environment and be aware of different modes of communications.
6. Understand the various levels of quality metrics and measurements.

UNIT-I
Software Project Management: Introduction, Importance, Software Projects Vs Other types of Projects, Contract Management, Technical Project Management, Activities covered by SPM, Plans, Methods and Methodologies. Setting Objectives, Project Success and Failures, Management and Control.
Project Evaluation and Programme Management: Project port polio management, Evaluation of Individual projects, Cost Benefit Evaluation Techniques, Risk Evaluation, Program Management, Managing the Resource with in the Program, Strategic Program Management, Aids to Program Management, **Overview of Project Planning.**

UNIT-II
Selection of an Appropriate Project Approach: Choosing the methodologies and technologies, Software process and process models.
Software Effort Estimation: Problems with Over and Underestimates, Software Effort Estimation Techniques. Function Point Analysis. A Parametric Productive Model – COCOMO-2
Activity Planning: Objectives of Activity Planning, Schedules, Activities, Sequencing, Network Planning Models.

UNIT-III
Risk Management : Categories of Risk, A Frame work with Dealing with Risk, Evaluating Risk with the Schedule.
Resource Allocation: Nature of Resource, Identify Resource Requirements, Scheduling, Creating Critical path, Cost Schedules, Scheduling Sequence.
Monitoring & Control: Creating Framework, Collecting Data, Project Termination Review, Visualizing Progress, Cost Monitoring, Prioritizing Monitoring, Change Control, Software Configuration Management.

UNIT-IV
Managing Contracts: Types of Contracts, Stages in Contract Placement, Typical Terms of Contracts, Contract Management Acceptance.
Managing People in Software Environments: Organizational behavior, selecting the Right person for the Job, Instruction in the best methods, Motivations, the Oldham-hackman Job characteristics model, Stress, Health and Safety, Some Ethical and Professional concerns.
Working in Teams: Becoming a Team, Decision making, Organization and Team Structures, Coordination of dependencies, Communication genres, Communication plans, Leadership.

UNIT –V

Software Quality : The Place of Software Quality in Project planning, Quality Management Systems, Process Capability models, Software Reliability Quality plans,

ISO : ISO – 9126, Product and Process Metrics

An Overview of PRINCE 2 : Components of Prince 2.

Text Book:

1. Bob Hughes and Mike Cotterell "Software Project Management", 5th Edition, Tata McGraw Hill, 2010.

Suggested Reading:

1. Walker Rayce "Software Project Management: A Unified Framework", Addison Wesley, 1998.
2. Watts S. Humphrey "Managing Software Process", Addison – Wesley Pearson Education, 1998.

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16MC C126

OBJECT ORIENTED SYSTEM DEVELOPMENT

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

Objectives:

Students will:

1. Learn the concepts of nine UML diagrams.
2. Use the concepts of things and relationships in UML.
3. Learn about the structural and dynamic modeling.
4. Apply the concepts of Architectural modeling.
5. Acquire the concept and structure of RUP and USDP.
6. Study about the various models of USDP and core workflows.

Outcomes:

After completion of the course the students would be able to:

1. Understand the basic building blocks of UML.
2. Use the knowledge and applications of nine UML diagrams.
3. Learn the knowledge of how to model the object oriented applications through UML.
4. Acquire the knowledge of Structural and Behavioral modeling.
5. Apply the knowledge of dynamic and architectural modeling.
6. Study the concepts of RUP, USDP and models.

Unit – I:

UML Introduction, Why we model, introducing the UML, Building blocks of UML.Basic Behavioral Modeling, Use Cases, Use Case Diagrams, Structural Modeling, Object diagrams, Class Diagrams, Relationships, Advanced Relationships in Class diagrams.

Unit – II:

Dynamic modeling, Interactions, Interaction Diagrams, Events and signals, State Machines, Processes and Threads, State Chart Diagrams, Activity Diagrams.

Unit – III:

Architectural Modeling, Interfaces, Packages, Components, Component Diagrams, Design Patterns and Frame works, Deployment diagrams, Systems and models.

Unit – IV:

Unified Software Development Process, The Unified Process, The Four Ps, Use-Case- Driven Process, Architecture – Centric Process, Iterative and Incremental Process.

Unit – V:

Core Workflows, Capturing Requirements as Use Cases, Analysis Model, Design Model, Implementation Model and Test Model.

Text Books:

1. Grady Booch, James Rumbaugh, Ivor Jacbson, "The Unified ModelingLanguage – User Guide", 2nd Edition, Pearson Education, India, 2007.
2. Ivor Jacbson, Grady Booch, James Rumbaugh, "The Unified Software Development Process", Pearson Education, India, 2008.

Suggested Reading:

1. Grady Booch, Rabert A. Maksimehuc and Three more, " Object Oriented Analysis and Design with Applications", 3rd Edition, Pearson Education, 1991.
2. Craig Larman, "Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development", 3rd Edition, Pearson Education, 2008.
3. Ali Bahrami, "Object Oriented System Development", Irwin/Mc Graw Hill, 1999.

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16MC C127

MACHINE LEARNING

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

Objectives:
Student will:
1. Learn the concepts of Classification and Prediction.
2. Understand the mathematical concepts related to Multilayer perception.
3. Apply clustering techniques for unsupervised data.
4. Train classifiers and predictors on supervised data.
5. Find optimal models for decision making.
6. Design ensemble models for Classification.

Outcomes:
After completion of the course the students would be able to:
1. Acquire the basic knowledge of Machine Learning; identify algorithms, machine learning problems.
2. Classify data sets using classifiers.
3. Use prediction Techniques.
4. Recognize patterns using Machine Learning models.
5. Apply dimensionality reduction techniques on different datasets.
6. Design ensemble methods.

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, Derivingback.
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.

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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 Leaming “,MacGraw Hill, 1997
2. Stephen Marsland, “Machine Learning - An Algorithmic Perspective “, CRC Press, 2009.

Suggested Reading:

1. J F Khamber, Data Mning Concepts, Elsevier, 2007
2. Margaret H Dunham, “Data Mining”, Pearson Edition, 2003.
3. GalitShmueli, Nitin R Patel, Peter C Bruce, “Data Mining for Business Intelligence”, Wiley India Edition, 2007.
4. RajjallShinghal, “Pattern Recognition “, Oxford University Press, 2006.

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16MC C128

CRYPTOGRAPHY & NETWORK SECURITY

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

Objectives:

Students will:

1. Learn OSI Security architecture and classical Encryption techniques.
2. Acquire fundamental knowledge on the concepts of finite fields and number theory.
3. Understand various block cipher and stream cipher models.
4. Describe the principles of public key cryptosystems, hash functions and digital signatures.
5. Acquire the knowledge of Security practices and system security.
6. Gain the knowledge of e-mail, IP and Web security.

Outcomes:

After completion of the course the students would be able to:

1. Compare various cryptographic techniques.
2. Design secure applications.
3. Inject secure coding in developed applications.
4. Develop secure cipher models.
5. Generate secure e-mail, IP and Web security algorithms.
6. Build secure system.

Unit-I

Introduction & Number Theory : Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid salgorithm-Finite fields- Polynomial Arithmetic –Prime numbers-FermatsandEulers theorem-Testing for primality The Chinese remainder theorem- Discrete logarithms.

Unit-II

Block Ciphers & Public Key Cryptography: Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles

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of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

Unit-III

Hash Functions And Digital Signatures: Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.

Unit-IV

Security Practice & System Security: Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs-SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

Unit-V

E-Mail, IP& Web Security: E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSLAttacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

Text Books:

1. William Stallings, "Cryptography and Network Security", 6th Edition, Pearson Education, 2013.
2. Charle Kaufman, Radha Perlman and Mike Speciner "Network Security", Prentice Hall of India, 2002.

Suggested Reading:

1. Behrouz A. Forouzan, "Cryptography and Network Security", Tata McGraw Hill, 2007.

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16MC C129

OBJECT ORIENTED SYSTEM DEVELOPMENT LAB

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

Objectives:

Students will:

1. Learn basic operations of Rational Rose case tool .
2. View and browse the four sections of Rational Rose case tool.
3. Depict and model the diagrams of UML in Rational Rose case tool.
4. Know about the representation of Structural and Dynamic modeling.
5. Understanding the concepts of Architectural modeling and its representation.
6. Submit a technical report of the case study in IEEE format.

Outcomes:

After completion of the course the students would be able to:

1. Understood the browsing and viewing sections of Rational Rose case tool.
2. Gained the knowledge of selecting a case study and converting it to be suitable to model in UML.
3. Gained the knowledge to draw and model the UML diagrams.
4. Gained the practical knowledge of **st**ructural modeling of Object Oriented Applications through UML.
5. Gained the practical knowledge of dynamic modeling of Object Oriented Applications through UML.
6. Gained the knowledge of technical writing and documentation of the case study in IEEE format.

List of Experiments:

1. Use case Diagram
2. Class Diagram
3. Object Diagram
4. Sequence Diagram
5. Collaboration Diagram
6. State chart Diagram
7. Activity Diagram
8. Component Diagram
9. Deployment Diagram

The students should finally submit a technical report on their case study in IEEE format.

Text Book:

1. Ivor Jacbson, Grady Booch, James Rumbaugh, “The Unified Software Development Process”, Pearson Education, India, 2008.

16MC C130

MACHINE LEARNING LAB USING PYTHON

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

Objectives:

Students will:

1. Learn the basic concepts and techniques of Machine Learning.
2. Develop the skills in using recent machine learning software for solving practical problems.
3. Be familiar with a set of well-known supervised semi-supervised and unsupervised learning algorithms.
4. Do experiments on real-time data for decision making.

Outcomes:

After completion of "**Machine Learning Lab**", the student is expected to:

1. Understand complexity of Machine Learning algorithms and their limitations;
2. Understand modern notions in data analysis oriented computing;
3. Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own.
4. Be capable of performing experiments in Machine Learning using real-world data.

Experiments:

1. Python Datatypes, Variables, Recursive Functions.
2. Strings, Lists, User defined functions, Tuples, Dictionaries.
3. Packages, Libraries of Python.
4. Demonstrating the Data preprocessing techniques.
5. Demonstration on How to get different datasets
6. Write a simple program on Simple Linear Regression
7. Multiple Linear Regression Backward Elimination – Preparation & Automatic Backward Elimination.

Use Decision Tree functions on real time data for

8. C4.5,
9. CART,
10. CHAID
11. Logistic Regression
12. K-Nearest Neighbors
13. Support Vector Machine with different kernals
14. Random Forest Classification

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Use clustering functions on real time data for

15. K-Means.
16. Hierarchical Clustering.

Use Association mining functions for

17. Apriori.

Apply Data compression techniques for real time data

18. Linear Discriminant Analysis (LDA).
19. Principal Component Analysis (PCA).

Text Book:

1. **Andreas C. Müller, Sarah Guido,** "ntroduction to Machine Learning with Python: A Guide for Data Scientists**"** O'Reilly Media, edition 1, 2016.

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16MC C131

SEMINAR

Instruction	3 Hours per week
Continuous Internal Evaluation	50 Marks
Credits	2

Objectives:

Students will:

1. Prepare a systematic and independent study of the state of the art technological topic in the broad area of his/her specialization.
2. Prepare PPT slides with the write-up and block diagrams of the selected area of study.
3. Present the selected topic and deliver a speech in front of the class and evaluating faculties.

Outcomes:

After completion of the course the students would be able to:

1. Conduct a independent technical study and survey on the selected topic.
2. Prepare a PPT slides presentation.
3. Deliver a speech and presentation of the study topic in front of the class and evaluating faculties.

Oral presentation is an important aspect of technical 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 his/her specialization.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects of the seminar presentation.

- Literature Survey.
- Organization of the material.
- Presentation of PPTs.
- Technical writing.

Each student is required to submit one page of synopsis of the seminar talk two days before for display on the notice board. Give a 15 minutes presentation followed by 5 minutes discussions. Submit a report on the seminar topic with a list of references and slides used within a week. Seminars are to be scheduled in the 5th week of the semester. The sessional marks will be awarded to the students by at least two faculty members on the basis of an oral and written presentation as well as their involvement in the discussion.

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16MC E110

INTERNET OF THINGS

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

Objectives:

Students will:

1. Gain vision and Introduction to IoT.
2. Understand IoT Market perspective.
3. Acquire IoT standards and Business processes.
4. Learn data and knowledge Management and use of Devices in IoT Technology.
5. Understand State of the Art – IoT Architecture.
6. Have knowledge of Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Outcomes:

After completion of the course the students would be able to:

1. Gain vision of IoT from a global context.
2. Determine the Market perspective of IoT.
3. Use Devices, Gateways and Data Management in IoT.
4. Implement IoT standards and Business processes.
5. Build state of the art architecture in IoT.
6. Develop Applications 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.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.

Unit-II

M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data Management.

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Unit-III

M2M and IoT Technology Fundamentals - Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management. IoT Architecture-State of the Art – Introduction, State of the art, Architecture Reference Model-Introduction, Reference Model and Architecture, IoT Reference Model.

Unit-IV

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.

Unit-V

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.

Text Book:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

Suggested Reading:

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.
HakimaChachi "Internet of Things (Connecting Objects)" Wiley – 2010.

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16MC E111

BUSINESS INTELLIGENCE AND ANALYTICS

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

Objectives:

Students will:

1. Learn data mining techniques and understand relationships between the underlying business process of an organization.
2. Understand the role of business analytics within an organization.
3. Acquire the knowledge on data warehousing concepts.
4. Provide in-depth knowledge of handling data and business analytics tools that is used for decision-making.
5. Acquire knowledge on prescriptive analytics.
6. Understand the various applications of business analytics on different domains.

Outcomes:

After completion of the course the students would be able to:

1. Get clear idea about the basic concepts of business analytics in an organization.
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 data warehousing and data mining concepts.
5. Understand the usefulness of business analytics in various functional areas of an organization.
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

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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- optimization, 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, DursunDelen, Efraim Turban, “Business intelligence and analytics” Pearson, 2013.
2. Jean paulisson,jesse s.harriot,”Win with advanced Business analytics” wiley and sas, 2012.

Suggested Readings:

1. Gert H.N. Laursen, JesperThorlund “Business Analytics for Managers” JohnWiley& Sons, Inc.2010.

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16MC E113

BIG DATA ANALYTICS

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

Objectives:
Students will:

1. Introduce the concepts and challenges of big data, role of HDFS in handling big data and MapReduce Architecture.
2. Explore mapper and reducer to solve real world problems.
3. Introduce the features of NoSQL and study the working mechanisms of MongoDB.
4. Impart knowledge to work with semi structured and unstructured data using Pig.
5. Familiarize with features of Hive to process and query big data.
6. Process and query the big data in HDFS environment.

Outcomes:
After completion of the course the students would 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:
Introduction to Big data and its importance, Considering 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.

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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 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.

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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.

   VigneshPrajapati, "Big data Analytics with R and Hadoop", Packt Publishing, November 2013.

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16MC E114

E-COMMERCE

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

Objectives:

Students will:

1. Learn basics of E-Commerce.
2. Design the E-Commerce Network Infrastructure.
3. Study and the E-Commerce Security Issues and its solutions.
4. Learn the Various electronic Payment options.
5. Apply the various Electronic Advertisements.
6. Use the basics of M Commerce.

Outcomes:

After completion of the course the students would be able to:

1. Apply knowledge of Basics on E-Commerce and its Applications.
2. Obtain knowledge on E-Commerce Network Infrastructure.
3. Get Knowledge on E-Commerce Security Issues and its solutions.
4. Apply exposure on various electronic Payment systems.
5. Use the obtain knowledge on various Electronic Advertisements.
6. Gets Exposure on the basics of M Commerce.

Unit-I

Electronic Commerce: Introduction, definition, benefits, impact, classifications, Applications, Business models.

Electronic Data Interchange: Building blocks of EDI, Value added networks, Benefits of EDI, Applications of EDI.

Unit-II

Architecture: Introduction to Architecture and Frameworks. **Network Infrastructure**: LAN, Ethernet, WAN, Internet, TCP/IP Reference Models, Domain Name Servers (DNS), Internet and Industry Structure.

Information Distribution and Messaging: FTP and its Applications, e-mail, WWW Server, HTTP, Web Server Implementation.

Unit-III

Information Publishing Technology: Publishing, Web Browsing, HTML, CGI, Multimedia and its Objects, Virtual Reality Modelling Language (VRML). **Securing Business on Internet**: Vulnerable, Security policy and Procedures. Site Security, Protecting the Network, Firewalls, Securing the Web (HTTP) Service.

Securing the Network Transactions : Transaction Security, Cryptology, Cryptographic Algorithm, Public-Key Algorithm, Authentication Protocols, Digital Signature.

Unit-IV

Electronic Payment Systems: Introduction, Online-Payment Systems, Pre-Paid, Post Paid, Requirements Metrics of a Payment System. Search Engine and Directory services.

Internet Advertising: Introduction, Competitive advertising media, Models of Internet Advertising, Banner, Sponsoring, Screen saver, Push Broadcasting, Corporate Web Sites.

Unit-V

Mobile Commerce : Introduction, Benefits, Frameworks, Agents in Electronic Commerce, Types, Agent Technologies, Agent Standards and Protocols, Agent Applications.

Text Book:

1. Bharat Bhasker "Electronic Commerce: Framework, Technologies and Applications", Tata McGraw-Hill Education, 2006.

Suggested Reading:

1. Ravi Kalakota& AB.B. Whinston – "Frontiers of Electronic Commerce ", Pearson Education, India 1999.
2. Daniel Minoli, Emma Minoli : "Web Commence Technology Handbook", Tata McGraw Hill, 2007.

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16MC C132

MAJOR PROJECT WORK

Instruction	6 Hours per week
Semester End Examination	Viva Voce
Continuous Internal Evaluation	100 Marks
Semester End Examination	100 Marks
Credits	12

Objectives:

Students will:

1. Understand the client /user project requirements.
2. Develop a software life cycle mechanism for the given problem scenario
3. Convert the project requirements in a implementable format.
4. Develop test cases and testing scenario to the code generated.
5. Document the entire project work in a IEEE format.

Outcomes:

After completion of the course the students would be able to:

1. Understand to capture project requirements from the client/end users.
2. Understand and implement software life cycle for the given requirements.
3. Design a real time solution for the given software requirement specifications
4. Understand how to develop test cases and design test case scenarios.
5. Document the entire project work in IEEE standards and format.

Sixth (Final) Semester of the MCA course is exclusively meant for Major Project work. Major Project Work has to be carried out by each student individually in a period of 15 weeks of duration. Students should submit a synopsis at the end of 2nd week in consultation with the Project Guide. The synopsis should consist of definition of the problem, scope of the problem and plan of action. After completion of eight weeks students are required to present a Project Seminar on the topic covering the aspects of analysis, design and implementation of the project work to the committee consisting of two faculty members of MCA department in the college along with a guide will evaluate the project and award internal marks.

At the end of the semester the students are required to present their project work before the External Committee for Vive-Voce examination, in which each student will be awarded with marks.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTOMOUNS)
Affiliated to OU; Accredited by NBA;
Accredited by NAAC-'A' Grade (UGC); ISO 9001: 2015
Gandipet, Hyderabad – 500075

Scheme of Regulations, Instruction, and Syllabi
of
MODEL CURRICULUM
of
BE I TO VIII SEMESTERS OF
FOUR YEAR DEGREE COURSE

IN

COMPUTER SCIENCE AND ENGINEERING

TABLE OF CONTENTS

Academic Rules

I. Preliminary Definitions And Nomenclature

These rules are applicable to the students who are admitted to BE/B.Tech (Eight Semesters) programme from the academic year 2018-2019. The preliminary definitions and nomenclature are furnished in the following table.

S. No	Keywords	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.	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
8.	Grade Point	It is a numerical weight allotted to each letter grade on a 10-point scale.
9.	Credit Point	It is the product of grade point and number of credits for a Course
10.	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 a student 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.
11.	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.
12.	Grade Sheet	Based on the grades earned, a grade sheet shall be issued to all the registered students after every semester. The grade sheet will display the course details (Course title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

II. Types of Courses in the Programme

Courses in a programme may be of the following kinds:

- Humanities and Social Sciences including Management courses
- Basic Science courses
- Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc
- Professional core courses
- Professional Elective courses relevant to chosen specialization/branch
- Open subjects – Electives from other technical and /or emerging subjects
- Project work, seminar and internship in industry or elsewhere
- Mandatory (non-credit)Courses: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge

III. 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 0-1-3 will be assigned two and half (2.5) credits.

L	T	P	C
0	1	3	2.5

IV. Course Structure and Sample Scheme for eight semesters

The following table shows the course structure with the credit weightage distribution.

Chaitanya Bharathi Institute of Technology (A)					
Name of the Program : B.E/B.Tech (Detailed Structure)					
L-Lecture, T-Tutorial, P-Practical/Drawing/Project/Seminar					
S.No	Name of the Course	No . of Hours			Credits
		L	T	P	
1.	**Humanities and Social Sciences including Management courses (10 Credits)**				
	English	**2**		**2**	**3**
	Sof t Skills			**2**	**1**
	Principles of Management	**3**			**3**
	Engg. Economics and Accountancy	**3**			**3**
2.	**Basic Science courses (26 Credits)**				
	Physics	**3**	**1**	**3**	**5.5**
	Chemistry	**3**	**1**	**3**	**5.5**
	Ma thematics – I	**3**	**1**		**4**
	Ma thematics – II	**3**	**1**		**4**
	Ma thematics – III	**3**	**1**		**4**
	Biology	**3**			**3**
3.	**Engineering Science courses including workshop, drawing, basics of electrical/ mechanical/ computer etc (23 Credits)**				
	Workshop/Manufacturing Practice	**1**		**4**	**3**
	Engineering Graphics and Design	**1**		**4**	**3**
	Eng ineering Mechanics	**3**	**1**		**4**
	Basic Electrical Engineering	**3**	**1**	**2**	**5**
	Programming for Problem Solving	**3**		**4**	**5**
	Basics of data structures	**2**		**2**	**3**
4.	**Professional core courses (61 Credits)** **(To be exercised by the respective department Board of Studies)**				
5.	**Professional Elective courses relevant to chosen specialization/branch (18 Credits)** **(Six Electives are possible and each of 3 credits weighatge. To be exercised by the respective department Board of Studies)**				
6.	**Open subjects – Electives from other technical and /or emerging subjects (09 Credits)** **(Three open Electives are possible and each of 3 credits weighatge. To be exercised by the respective department Board of Studies)**				
7.	**Project work, seminar and internship in industry or elsewhere (13 Credits)**				
	Pro ject Part1 -(VII Semester)			**4**	**2**
	P ro ject Part2 -(VIII Semester)			**20**	**10**
	Technical Seminar (other than Project)- (VIII Semester)			**2**	**1**
	Internship – During Semester Break Industry Visits (At least two) During V and VII Semesters				
	8. Mandatory Courses (non-credit				
	Environmental Sciences				
	Indian Constitution				
	Essence of Indian Traditional Knowledge				
Induction training : To be conducted for Three weeks before commencement of I-Semester class work					
Total Credits :160					

A sample scheme/plan of study from I-semester to VIII-semester is furnished in the following tables and it is common to all the disciplines of B.E/B.Tech.

GROUP-1 (Civ/EEE/Mech/Prod/Chem/Bio)					
SEMESTER-I					
S. NO	Name of the Course	No . of Hours			Credits
		L	T	P	
1	Mathematics -1*	3	1	-	4
2	Physics	3	1	3	5.5
3	Programming for Problem Solving	3	-	4	5
4	Workshop/ Manufacturing Practice	1	-	4	3
5	English	2	-	2	3
	Total	12	02	13	20.5
	Clock Hours per week:27				

GROUP-1 (Civ/EEE/Mech/Prod/Chem/Bio)					
SEMESTER-II					
Sl NO	Name of the Course	No . of Hours			Credits
		L	T	P	
1	Mathematics -2*	3	1	-	4
2	Chemistry	3	1	3	5.5
3	Engineering Mechanics	3	1	-	4
4	Engineering Graphics and Design	1	-	4	3
5	Basic Electrical Engineering	3	1	2	5
	Total	13	04	09	21.5
	Clock Hours per week:27				

*In place of 'Mathematics-1 & 2', ' Basics of Biology -1&2' will be introduced for Bio-Tech(MPC) stream, and 'Engineering Mathematics- 1 & 2' will be introduced for Bio-Tech(BiPC) stream.

GROUP-2 (CSE/ECE/IT)					
SEMESTER-I					
S. NO	Name of the Course	No . of Hours			Credits
		L	T	P	
1	Mathematics -1	3	1	-	4
2	Chemistry	3	1	3	5.5
3	Engineering Mechanics	3	1	-	4
4	Engineering Graphics and Design	1	-	4	3
5	Basic Electrical Engineering	3	1	2	5
	Total	13	04	09	21.5
	Clock Hours per week:26				

GROUP-2 (CSE/ECE/IT)					
SEMESTER-II					
Sl NO	Name of the Course	No . of Hours			Credits
		L	T	P	
1	Mathematics -2	3	1	-	4
2	Physics	3	1	3	5.5
3	Programming for Problem Solving	3	-	4	5
4	Workshop/ Manufacturing Practice	1	-	4	3
5	English	2	-	2	3
	Total	12	02	13	20.5
	Clock Hours per week:27				

L : Lecture, T : Tutorial , P : Practical/Drawing/Seminar/Project

GROUP-1 (Civ/EEE/Mech/Prod/Chem/Bio)					
SEMESTER-III					
S. NO	Name of the Course	No . of Hours			Credits
		L	T	P	
1	Mathematics -3	3	1	-	4
2	Biology	3	-	-	3
3	Core 1	3	1	2	5
4	Core 2	3	1	2	5
5	Core 3	3	-	-	3
6	Indian Constitution	2	-	-	Non - Credit
7	Indian Traditional Knowledge	2	-	-	Non - Credit
	Total	19	03	04	20
	Clock Hours per week:26				

GROUP-1 (Civ/EEE/Mech/Prod/Chem/Bio)					
SEMESTER-IV					
Sl NO	Name of the Course	No . of Hours			Credits
		L	T	P	
	Basics of Data Structures	2	2		3
	Core 4	3	1	2	5
	Core 5	3	1	2	5
	Core 6	3			3
	Soft Skills			2	1
	Principles of Management	3			3
	Environmental Science	2	-	-	Non - Credit
	Total	16	04	06	20
	Clock Hours per week:26				

GROUP-2 (CSE/ECE/IT)					
SEMESTER-III					
S. NO	Name of the Course	No . of Hours			Credits
		L	T	P	
1	Mathematics -3	3	1	-	4
2	Basics of Data Structures	2	2	-	3
3	Core 1	3	1	2	5
4	Core 2	3	1	2	5
5	Soft Skills			2	1
6	Principles of Management	3	-	-	3
7	Environmental Science	2	-	-	Non - Credit
	Total	16	03	06	20
	Clock Hours per week:25				

GROUP-2 (CSE/ECE/IT)					
SEMESTER-IV					
Sl NO	Name of the Course	No . of Hours			Credits
		L	T	P	
1	Biology	3			3
2	Core 3	3	1	2	5
3	Core 4	3	1	2	5
4	Core 5	3		2	4
5	Core 6	3			3
6	Indian Constitution	2	-	-	Non - Credit
7	Indian Traditional Knowledge	2	-	-	Non - Credit
	Total	19	05	06	20
	Clock Hours per week:27				

L : Lecture, T : Tutorial , P : Practical/Drawing/Seminar/Project

SEMESTER-V					
S. NO	Name of the Course	No . of Hours			Credits
		L	T	P	
1	Core 7	3		2	4
2	Core 8	3		2	4
3	Core 9	3		2	4
4	Core Elective 1	3	-	-	3
5	Core Elective 2	3	-	-	3
6	Open Elective1/Engg. Economics and Accountancy	3	-	-	3
	Total	18	-	06	21
	Clock Hours per week:24				

SEMESTER-VI					
Sl NO	Name of the Course	No . of Hours			Credits
		L	T	P	
	Core 10	3		2	4
	Core 11	3		2	4
	Core 12	3		2	4
	Core Elective 3	3	-	-	3
	Core Elective 4	3	-	-	3
	Open Elective1/Engg. Economics and Accountancy	3	-	-	3
	Total	18	-	04	20
	Clock Hours per week:22				

SEMESTER-VII					
S. NO	Name of the Course	No . of Hours			Credits
		L	T	P	
1	Core 13	3	-	3	4.5
2	Core 14	3	-	3	4.5
3	Core 15	3	-	-	3
4	Core Elective 5	3	-	-	3
5	Open Elective 2	3	-	-	3
6	Project Part 1	-	-	4	2
	Total	15	-	10	20
	Clock Hours per week:25				

SEMESTER-VIII					
Sl NO	Name of the Course	No . of Hours			Credits
		L	T	P	
1	Core Elective 6	3	-	-	3
2	Open Elective 3	3	-	-	3
3	Technical Seminar(on latest trends and other than Project	-	-	2	1
4	Project Part 2	-	-	20	10
	Total	18	-	04	20
	Clock Hours per week:28				

L : Lecture, T : Tutorial , P : Practical/Drawing/Seminar/Project

Summary...									TOTAL CREDITS
Semester	I	II	III	IV	V	VI	VII	VIII	
Credits	20.5	21.5	20	20	21	20	20	17	160
Credits	21.5	20.5	20	20	21	20	20	17	

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

V. Examination, Assessment and Letter Grades/Grade Points

In assessing the performance of the students in examinations, the approach is to award marks based on the examinations conducted at various stages (CIE and semester 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.

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 tables for theory courses and laboratory/project/seminar courses.

For Theory/Engg. Graphics courses...			
% 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

For Laboratory/Project/Seminar courses...			
% 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
<50	0.00	F	Fail
----	0.00	Ab	Absent

A student obtaining Grade F shall be considered failed and will be required to reappearing 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. For the non-credit courses, the students must have secured ' Satisfactory' for the award of degree along with other requirements.

VI. 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.,

$$\textbf{SGPA}\ (S_i) = \Sigma(C_i \times G_i) / \Sigma C_i$$

where **Ci** is the number of credits of the ith course and Gi is the grade point scored by the student in the ith 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.

$$\textbf{CGPA} = \Sigma(C_i \times S_i) / \Sigma\ C_i$$

where Si is the SGPA of the ith 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.

Grade Sheet: Based on the above guidelines on Letter grades, Grade points and SGPA and CCPA, the institute issues the grade sheet for each semester and a consolidated grade sheet indicating the performance in all semesters.

VII. 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
Three (3),Two(2) Credits/One and Half(1.5) Credits	25	50	Lab Course /Workshop	3 Hours
One(1) Credit	15	35	Lab Course	2 Hours
Two(2) Credits	50	--	Project Part 1	--
Ten (10) Credits	100	100	Project Part 2	Viva
One (1) Credit	50	--	Technical Seminar	--
One (1) Credit	50	--	Mini Project	--
Non- Credit	--	50***	Environmental Sciences, Indian Constitution and Essence of Indian Traditional Knowledge	2 Hours

CIE: Continuous Internal Evaluation

* Out of 30/20 sessional marks(CIE), 10/5 marks are allotted for slip-tests (Two slips tests and two assignments will be conducted, each of 10/5 marks, best three 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 questions, each question will have internal choice. (The question paper with five questions is framed from the respective five units).

***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 questions and each question will have internal choice. (The question paper with five questions is framed from the respective five units).

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%.

For non-credit courses also the minimum pass mark is 40% and the students who secures more than are equal to 40% of maximum mark, then the student will be awarded with 'Satisfactory' otherwise they will be awarded with 'Not-satisfactory'. The students must have secured with 'Satisfactory' in these non-credit courses for the award of degree.

VIII. Duration of the programmes and Credit Requirements for the award of degree

A student is normally expected to complete the B.E. / B.Tech. Programme in eight(8) Semesters but in any case not more than Twelve(12) 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 being taught.

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. Credit Requirement for the award of B.E/B.Tech degree is 160 and in the non-credit courses, the student must have secured with 'Satisfactory' grade .

IX. 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 the required 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.

   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 four (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 enroll 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.1000.00.

X. Promotion Rules

The following rules are applicable to the students who are taking admission into first year of B.E/B.Tech programme in the academic year 2018-19.

S.No.	Semester	Conditions to be fulfilled
1	From I-Sem to II-Sem	i) Regular course of study of I-Sem. ii)Student must secure atleast 40% of maximum marks of CIE of I-Semester
2	From II-Sem to III-Sem	i) Regular course of study of II-Sem. ii) Student must secure atleast 40% of maximum marks of CIE of II-Semester ii) Student Must have earned at least 21Credits of I& II Semester.
3	F rom III-Sem to IV-Sem	i) Regular course of study of III-Semester. ii) Student must secure atleast 40% of maximum marks of CIE of III-Semester
4	F rom IV-Sem to V-Sem.	i) Regular course of study of IV-Sem. ii) Student must secure atleast 40% of maximum marks of CIE of IV-Semester iii) Student must have earned atleast 62 Credits of I,II III and IV Semesters.
5	From V-Sem to VI Sem	i) Regular course of study of V-Semester. ii) Student must secure atleast 40% of maximum marks of CIE of V-Semester
6	From VI-Sem to VII-Sem	i) Regular course of study of VI-Sem. ii) Student must secure atleast 40% of maximum marks of CIE of VI-Semester iii) Student must have earned atleast 102 Credits of I,II,III,IV,V and VI Semesters.
7	From VII-Sem to VIII-Sem	i) Regular course of study of VII Semester. ii) Student must secure atleast 40% of maximum marks of CIE of VII-Semester

The following rules are applicable to the promotion of lateral entry students from one semester to the next semester who will be taking admission of B.E/B.Tech programme in the academic year 2019-20

S.No.	Semester	Conditions to be fulfilled
1	F rom III-Sem to IV-Sem	i) Regular course of study of III-Sem. ii)Student must secure atleast 40% of maximum marks of CIE of III-Semester
2	F rom IV-Sem to V-Sem.	i)Regular course of study of IV-Sem. ii)Student must secure atleast 40% of maximum marks of CIE of IV-Semester ii) Student Must have earned at least 20 Credits of III and IV Semesters.
3	From V-Sem to VI Sem	i)Regular course of study of V-Semester. ii) Student must secure atleast 40% of maximum marks of CIE of V-Semester
4	From VI-Sem to VII-Sem	i)Regular course of study of VI-Semester. ii) Student must secure atleast 40% of maximum marks of CIE of VI-Semester iii)Student must have earned atleast 60 Credits of III, IV,V and VI Semesters.
5	From VII-Sem to VIII-Sem	i)Regular course of study of VII Semester. ii)Student must secure atleast 40% of maximum marks of CIE of VII-Semester.

XI. Reappearing /Readmission/Revaluation/Physical Verification of answer scripts

If a student fails in a theory course/lab course, the student has to appear 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 take re-admission of that particular semester (by paying appropriate tuition fee as prescribed by the institute) when offered next and must attend the classes and fulfill the attendance requirements.

A student can apply for revaluation of the student"s semester examination answer paper in a theory course, within two(2) weeks from the declaration of results, on payment of a prescribed fee along with prescribed application.

After the declaration of results, the interested student(s) can go through/evidence their semester end theory examination answer scripts (by paying the prescribed fee) physically on issuing of the notification by the respective authorities.

The student(s) who have failed in the courses for which there is only internal evaluation, such students are required to reappear for the same, when offered next time, by the respective department.

If a student is detained due to non-earning of required credit(s), such student(s) are eligible for re-admission after earning the required number of credits only. Further, if any student is detained due non-earning of required credit(s) and wants to repeat the semester class work, such students are eligible for re-admission in the odd semesters only, such students are required pay tuition fee as per the institute rules

The student who has failed the course for which there is only CIE, such students required the reappear for the same when offered next time by the respect the department.

XII. 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/Principal 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 grade 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.**

Students are permitted to complete online certification courses through Massive Open Online Courses (MOOCs) offered by reputed Universities/ Government Organizations duly approved by the Head of the Department. The Credits allotted for the Certification course is one (1)/ two (2)/three(3) Credit(s) and will be decided by the Head of the Department.

A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOCs. 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** 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 IVsemester 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.**

XIII. Common Course Committee

A theory course handled by more than one teacher shall have a "Common Course Committee" comprising of 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 CIE 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) shall prepare a common question paper for the continuous internal evaluation.

XIV. Multiple Courses Committee and Overall Monitoring Committee

Course(s) handled by a single teacher, there will be a "Multiple Courses Committee" comprising of all the above teachers and two student representatives from each course. One of the above teachers, nominated by 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.

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 students

of the semester concerned for any of the committee meetings if necessary.

XV. Revision of Regulations, Curriculum and Syllabi

The institute may revise from time to time, amend or change the Rules & Regulations, Syllabus and Scheme of examinations after obtaining approval by Academic Council.

XVI. 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 and other requirements as specified in the curriculum corresponding to the student‟s programme within the stipulated time. Successfully completed the course requirements, appeared for the Semester End Examinations and passed all the subjects prescribed in all the eight(8) semesters within a maximum period of six(6) academic 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.

A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOC/NPTEL.
No disciplinary action pending against the student.
The award of Degree must have been approved by the University.

XVII. 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.

XVIII. Award of Division

CGPA	DIVISION
7.0 and above	First Class with distinction
6.0 and less than 7.0	First Class
5.0 and less than 6. 0	Second Class
4.0 and less than 5.0	Pass

XIX. Award of Gold Medal

A student securing highest CGPA in single attempt is eligible for award of Gold Medal in the course of B.E/B.Tech for each specialization/Branch.

XX. Additional rules for lateral entry students

These are applicable to the students who are admitted directly through ECET to the III semester of BE/B.Tech programme from the academic year 2019-2020. These students are admitted as per the rules governed by Telangana State government. These students are waived with all the courses of I-semester and II-Semester curriculum of regular eight semesters B.E/B.Tech programme. All the rules except the **'promotion rules and credit requirement for the award of degree'** are same as that of eight semesters B.E/B.Tech programme under CBCS. However, the students need to undergo two(2) bridge courses and are furnished below:

1. C- programming Lab (Lab Course)
2. English Language Lab (Lab Course)

The above said course(s) will be offered by the respective departments of the institute and they are mandatory for every student. The students need to secure atleast 'D' grade in all the above two(2) courses. The grades secured in these courses shall not be considered for dropping any elective/core course or in the process of award of degree. It is a pre requisite for the award of Degree for securing atleast “D" grade in all the above said bridge courses.

Credit requirement for the award of degree for lateral entry students: 118

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.

XXI. Annexure

Industrial Training / Internship

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

<u>“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 ”</u>

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/organization and discuss with CEO/Director /Responsible person of that industry/organization 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 incharge
   - to monitor 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/organization, 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/organization 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/organization. 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/organization.
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) by the student for Industrial Training / Internship.

Note: The credits earned by the student towards the Industrial Training/
Internship for two(2) to four(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:

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:

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.

AICTE - Model Curriculum

B.E Syllabus for I and II Semester
with effect from 2018 – 2019

Specialization /Branch: Computer Science and Engineering

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

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

SEMESTER – I

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18MT C01	Mathematics -I	3	1	-	3	30	70	4
2	18CY C01	Chemistry	3	1	-	3	30	70	4
3	18CEC01N*	Engineering Mechanics	3	1	-	3	30	70	4
4	18CS C01	Programming for Problem Solving	3	-	-	3	30	70	3
PRACTICALS									
5	18MEC01N*	Engineering Graphics and Design	1	-	4	3	50	50	3
6	18CS C02	Programming for Problem Solving Lab	-	-	4	3	25	50	2
7	18CY CO2	Chemistry Lab	-	-	3	3	25	50	1.5
Total			**13**	**03**	**11**	**-**	**200**	**450**	**21.5**

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

18MT CO1

MATHEMATICS–I

(Common to all branches and except for Bio-Tech)

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

Course Objectives: The objectives of this course are

1. To solve linear system of equations using Matrix Methods.
2. To know the convergence of the Series.
3. To represent the function in series form.
4. To know the Partial Derivatives and use them to interpret the way a function of two variables behaves.
5. To learn Vector Differential Operator and its Physical interpretations on Scalars and vector functions.
6. To solve improper integrals.

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

1. Solve system of linear equations and identify the Eigen values and Eigen vectors in engineering problems.
2. Check the series convergence.
3. Find the evolutes of the given curves.
4. Expand and find extreme values of functions of two variables.
5. Understanding the significance of gradient, divergence and curl.
6. An ability to solve the problems and interpret in geometrical approach.

UNIT-I

Matrices: Rank of the matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Eigenvalues, Eigenvectors, Properties of eigenvalues, Cayley-Hamilton theorem, Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic forms.

UNIT-II

Sequences and Series: Definition of Convergence of sequence and series. Tests for convergence of series: Comparison test, limit comparison test, D'Alembert ratio test, Raabe's test, Cauchy's n^{th} root test, logarithmic test, alternative series, absolute and conditional convergence.

UNIT-III

Calculus: Rolle's Theorem, Lagranges Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, radius of curvature, Evolutes and involutes. Fourier series, half range sine and cosine series.

UNIT-IV

Multivariable Calculus (Differentiation): Functions of two variables, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions of two variables, Lagrange's multipliers method.

UNIT-V

Vector Calculus (Differentiation): Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, vector identities. Improper integrals: Beta and Gamma functions and their properties.

Text Books:

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

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw- Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

18CY C01

CHEMISTRY
(Common **to** all branches)

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

Course Objectives: The objectives of this course are

1. 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.
2. This syllabus helps at providing the necessary introduction of the inorganic chemistry principles and concepts of chemical bonding involved in a comprehensive manner understandable to the students aspiring to become practicing engineers.
3. Thermodynamic and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
5. New materials lead to discovering of technologies in strategic areas like defense and space research for which an insight into nano and composite materials of modern chemistry is essential.

Course Outcomes: On Successful completion of the course, students will be able to
The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations & Ionic Equilibria.
3. List major chemical reactions that are used in the synthesis of molecules.
4. Apply the various methods used in treatment of water for domestic and industrial use.
5. Discuss the various Engineering materials & Drug synthesis & their applications.

UNIT-I Atomic and Molecular Structure:
Molecular Orbital theory - atomic and molecular orbitals.Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Energy level diagrams of diatomics (H_2 , $He_2^{\ +}$,N_2 , O_2 , $O_2^{\ -}$, CO, NO). Pi- molecular orbitals of butadiene, benzene and their aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

UNIT-II Use of Free Energy in Chemical Equilibria and Ionic Equilibria:
Use of free energy in chemical equilibria : Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials –electrochemical series. Nernst equation and its applications. Potentiometric Acid base & Redox Titrations. Numericals.
Ionic Equilibria: Solubility product, Determination of solubility product, Applications of solubility product- Determination of solubilities of sparingly soluble salts; Predicting precipitation reactions; Precipitation of an insoluble salt; Precipitation of soluble salts; Inorganic analysis. Numericals.

UNIT- III Stereochemistry and Organic Reactions
Stereochemistry: Representations of 3 dimensional structures, Symmetry and chirality, Stereoisomers - Configurational isomers (Geometrical & Optical isomers), Conformational isomers - Newman and sawhorse representations of n-butane, enantiomers (lactic acid), diastereomers (Tartaric acid) , optical activity, absolute configurations , Sequence rules for R&S notation.
Organic Reactions Types of Organic reactions:
Substitution Reactions- Electrophilic substitution (Nitration of Benzene) ; Nucleophilic Substitution (S_N1& S_N2) ; Free Radical Substitution(Halogenation of Alkanes)
Addition Reactions:
Electrophilic Addition – Markonikoff's rule
Nucleophilic Addition – (Addition of HCN to carbonyl compounds)
Free radical Addition - Anti Markonikoff's rule (Peroxide effect)
Eliminations-E_1 and E_2 (dehydrohalogenation of alkyl halides) **Oxidation** with $KMno_4$, K_2 Cr_2O_7 ; **Reduction** with $LiAlH_4$,$NaBH_4$ **Cyclization** (Diels - Alder reaction)

UNIT–IV 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, Ozonisation & UV radiation.

UNIT-V Engineering Materials and Drugs:

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.

Conducting polymers- Definition, classification and applications.

Drugs-Introduction,Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company Ltd., New Delhi,16^{th} edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, “Selected topics in Inorganic Chemistry”, S Chand & CompanyLtd, New Delhi,reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, “Organic Chemistry”, Pearson, Delhi, 7^{th}edition(2011).
4. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C. Sudhakar, “Drugs”, Universities Press (India) Limited, Hyderabad (2007).

Suggested Reading:

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

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18CE C01N

ENGINEERING MECHANICS

(Common to all branches)

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

Course Objectives: The objectives of this course are

1. Concept of forces, resolution, resultant, moment, couple and equilibrium of force systems.
2. Effect of frictional resistance to force systems and methods of analysing the simple trusses.
3. Centroid, centre of gravity and area moment of inertia for various regular and composite lines, areas and volumes.
4. Basic concepts of dynamics (kinematics and kinetics) and analysis of particle motion and connected bodies.
5. Work energy principle, impulse-momentum equation and their applications for translatory motion bodies.

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

1. Solve problems dealing with forces in plane systems, draw free body diagrams and analyse problems using equilibrium equations for a smooth surface.
2. Solve problems involving force system with frictional resistance and to analyse simple trusses for forces in various members of a truss.
3. Determine centroid and area moment of inertia for elementary and composite figures.
4. Solve problems in kinematics and kinetics of a particle and connected systems.
5. Solve problems for body motion using work energy principle and impulse-momentum approach for translatory motion bodies.

UNIT–I

Resolution, Resultant and Equilibrium of Force System: Concepts of force, system of forces, components of forces in a plane. Resultant of coplanar- concurrent force systems. Moment of a force and its applications. Couple and its applications. Resultant of coplanar-non-concurrent force systems. Equilibrium of force systems. Free body diagram, equations of equilibrium for coplanar force system.

UNIT–II

Friction and Analysis of Simple Trusses: Types of friction, laws of friction, application of friction to a single body and connecting systems, wedge friction. Analysis of simple trusses using method of joints and method of sections.

UNIT–III

Centroid, Centre of Gravity and Moment of Inertia: Centroid of lines and areas from first principle, centroid of composite figures. Centre of gravity and its implications. Area moment of inertia of a plane section from first principles, theorems of moment of inertia, moment of inertia of composite sections.

UNIT–IV

Particle Dynamics: Kinematics: Rectilinear and curvilinear translation. Rectangular, normal and tangential components of acceleration. General principles of kinetics: D' Alembert's principle and its application to particle motion and connected bodies.

UNIT–V

Work-Energy and Impulse-Momentum: Equation of work energy for translation- applied to particle motion and connected systems. Introduction to linear impulse- momentum, principle of conservation of linear momentum and its applications.

Text Books:

1. 1. K. Vijaya Kumar Reddy and J. Suresh Kumar, "Singer's Engineering Mechanics: Statics and Dynamics", B. S. Publications (SI Units), 3rd edn., Rpt.,2019.

Suggested Reading:

2. Nelson., "Engineering Mechanics", Tata Mc Graw Hill, Delhi, 2010.
3. K. Tayal , "Engineering Mechanics: Statics and Dynamics", Umesh Publications, Delhi, 14th edn., Rpt., 2015.
   1. Basudeb Bhattacharyya, "Engineering Mechanics", Oxford University Press, 2nd edn., 2016.

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18CS C01

PROGRAMMING FOR PROBLEM SOLVING
(Common to All Programs)

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

Course Objectives

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

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

1. Identify the computing environments.
2. Formulate solutions to problems and represent them using algorithms/ Flowcharts.
3. Choose proper control statements and data structures to implement the algorithms.
4. Decompose a problem into modules and use functions to implement the modules.
5. Develop applications using file I/O.

UNIT-I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping and nested statements.

Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes. **Case study**

UNIT – III

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting(selection and bubble) algorithms, 2-D arrays, matrix operations.

Strings: Introduction, string representation, string operations with examples. **Case study**

UNIT – IV

Pointers: Understanding computer's memory, introduction to pointers, declaration of pointer variables, pointer arithmetic, pointers and strings, array of pointers, function pointers, array of function pointers, dynamic memory allocation, advantages and drawbacks of pointers.

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions and enumerated data types.

UNIT-V

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

Preprocessor Directives: Types of preprocessor directives, examples.

Text Books:

1. A K Sharma "Computer Fundamentals and Programming", 2nd Edition, University Press, 2018.
2. PradeepDey and Manas Ghosh, "Programming in C", Oxford Press, 2nd Edition, 2017.

Suggested Reading:

1. Byron Gottfried, Schaum's"Outline of Programming with C", McGraw- Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. ReemaTharaja "Introduction to C Programming", Second Edition, OXFORD Press,2015.
5. https://www.tutorialspoint.com/cprogramming/index.htm.
6. https://onlinecourses.nptel.ac.in/noc18-cs10/preview.

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18ME C01N

ENGINEERING GRAPHICS AND DESIGN

Instruction	1 Lecture + 4 Drawing Hours per week
Duration of Semester End Examination	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	3

Course Objectives: The objectives of this course are

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

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

1. Exposure to graphics package.
2. Exposure to the visual aspects of engineering design.
3. To become familiar with engineering graphics standards.
4. Exposure to orthographic projections.
5. Exposure to engineering communication.

List of exercises:

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

Text Books:

1. N.D.Bhatt, "Elementary Engineering Drawing", Charotar Publishers, 2012.
2. K.L.Narayana and P.K.Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011.
3. Basanth Agrawal and C M Agrawal, "Engineering Drawing", 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., "Engineering Drawing", *2/e,* Pearson, 2009.
2. K.Veenugopal, "Engineering Drawing and Graphics + AutoCAD", New Age International Pvt.Ltd, 2011.
3. Bhattacharya. B, "Engineering Graphics", I. K. International Pvt. Ltd, 2009.

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18CS 02

PROGRAMMING FOR PROBLEM SOLVING LAB

Instruction	4 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	50 Marks
Sessional	25 Marks
Credits	2

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

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Identify and rectify the syntax errors and debug program for semantic errors.
4. Solve problems in a modular approach using functions.
5. Implement file operations with simple text data.

List of Experiments:
1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. Simple functions.
6. Recursive functions.
7. 1D Array manipulation.
8. 2D arrays and strings.
9. Matrix problems, String operations.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling Design the experiments in such a way that the students will be able to end up the solution for a real world problem that uses most of the concepts of C programming language. For example: A banking application where it uses the concepts of operators, control structures, switch case for menu, structures, functions, error handling, files etc.

Text Books:

1. Pradeep Dey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017.
2. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press, 2015.

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

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18CY C02

CHEMISTRY LAB
(Common to all branches)

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

Course Objectives: The objectives of this course are
1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. The student should be conversant with the principles of volumetric analysis and identification of organic functional groups.
3. To apply various instrumental methods to analyze the chemical compounds and to improve understanding of theoretical concepts.

Course Outcomes:
The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. On Successful completion of the course, students will be able to
1. Identify the basic chemical analysis methods to calculate the substances quantitatively.
2. Determine the rate constants of reactions from concentration of reactants/ products as a function of time
3. Calculate the concentration and amount of various substances using instrumental techniques.
4. Develop the basic drug molecule and Identify the organic compounds
5. Analyse the molecular properties such as surface tension and viscosity

Chemistry Lab
1. Estimation of temporary and permanent hardness of water using EDTA solution
2. Estimation of amount of chloride in water.
3. Determination of rate constant for the reaction of hydrolysis of methyl acetate.(first order)
4. Estimation of amount of HCl Conductometerically using NaOH solution.
5. Estimation of (a) amount of CH_3 COOH Conductometerically using NaOH solution. (b) amount of HCl and CH_3 COOH present in the given mixture of acids Conductometerically using NaOH solution.
6. Estimation of amount of HCl Potentiometrically using NaOH solution.
7. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution.
8. Distribution of acetic acid between n-butanol and water.
9. Synthesis of drug - Aspirin.
10. Organic Chemistry- Identification of Functional groups - neutral group (carbonyl groups-acetaldehyde and acetone); acidic group(benzoic acid); basic group (aniline)
11. Determination of surface tension of organic solvents (ethanol, ethyl acetate)
12. Determination of Viscosity.

Text Books:
1. J. Mendham and Thomas,"Vogel' s text book of quantitative chemical analysis",Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.

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

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

SEMESTER – II

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE inHours	MaximumMarks		
			L	T	P/D		CIE	SEE	
	THEORY								
1	18MT C03	Mathematics -II	3	1	-	3	30	70	4
2	18PY C01	Optics and Semiconductor Physics	3	1	-	3	30	70	4
3	18CS C03	Object-Oriented Programming	3	-	-	3	30	70	3
4	18EG C01	English	2	-	-	2	20	50	2
	PRACTICALS								
5	18PY C02	Optics and Semiconductor Physics Laboratory	-	-	3	3	25	50	1.5
6	18CS C04	Object-Oriented Programming Lab	-	-	4	3	25	50	2
7	18ME C02	Workshop/ Manufacturing Practice	1	-	4	3	25	50	3
8	18EG C02	English Lab	-	-	2	2	15	35	1
Total			**12**	**02**	**13**	**-**	**200**	**445**	**20.5**

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

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18MT C03

MATHEMATICS-II

(Common to all branches and except for Bio-Tech)

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

Course Objectives: The objectives of this course are

1. To evaluate double and triple integrals of various functions and their significance.
2. To evaluate vector line, surface and volume integrals.
3. To know the relevant method to solve higher order differential equations.
4. To evaluate complex integration.
5. To evaluate real and definite integrals.
6. To know the methods to solve real life problems.

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

1. Find the areas, volumes and surface of solids revolution.
2. Use Greens, Gauss and Stoke's theorems to find the surface and volume integrals.
3. Able to solve solutions of differential equations with initial and boundary value problems.
4. Solve the problems on analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Real and complex integrals by using Cauchy's theorems.
6. Solve physical and engineering problems.

UNIT-I

Multivariable Calculus (Integration): Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals, Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities).

UNIT-II

Vector Integral Calculus: Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem and Stoke's theorem (without proof). **First Order Ordinary Differential Equations:** Exact first order differential equations , Integrating factors, Linear first order equations , Bernoulli's, Riccati's and Clairaut's differential equations ,Orthogonal trajectories of a given family of curves.

UNIT-III

Ordinary Differential Equations of Higher Orders: Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point and regular singular point, Power Series solution. Legendre Polynomial of first kind (without proof), Rodrigues formula, Generating function, recurrence relations, orthogonality of Legendre polynomials, Bessel's function of first kind (without proof), recurrence relations and problems.

UNIT-IV

Complex Variables – I: Differentiation, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties. Conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof).

UNIT-V

Complex Variables – II: Liouville's theorem and Maximum-Modulus theorem (without proof). Taylor's series, Laurent's series, zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine. Improper real integrals with singular points on the upper half plane.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications,5th edition,2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson, Reprint, 2002.

18PY C01

OPTICS AND SEMICONDUCTOR PHYSICS

(for CSE, ECE & IT)

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

Course Objectives: The objectives of this course are

1. Understands the fundamentals of wave nature of light.
2. Acquires knowledge of lasers.
3. Familiar with Quantum Mechanics.
4. Learns the fundamental concepts of solids.
5. Understands the basics of semiconductors.

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

1. Demonstrate the wave nature of the light.
2. Describe the types of lasers and their applications.
3. Explain the importance of wave mechanics.
4. Demonstrate the importance of band theory of solids.
5. Identify the semiconductors for engineering applications.

UNIT-I

Wave Optics: Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

UNIT-II

Lasers: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

UNIT-III

Wave Nature of Particles and Schrodinger Equation: Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time independent Schrodinger equation for wavefunction, Born interpretation, probability current, Expectation values, Free-particle wavefunction and wave-packets, Uncertainty principle.

UNIT – IV

Introduction to Solids: Free electron theory of metals, Fermi level, density of states, Application to white dwarfs and neutron stars, Bloch's theorem for particles in a periodic potential, Kronig-Penney model, Scattering from a potential barrier and tunneling; related examples like alpha-decay, field-ionization and scanning tunneling microscope.

UNIT-V

Semiconductors: Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Thermistor, Hall effect, LED, Solar cell.

Text Books:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text BookEngineering 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 Limited; 6th Revised edition, 2015.

18CS C03

OBJECT ORIENTED P ROGRAMMING

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

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

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand the concepts Object-Oriented Programming Languages.
2. Adequately use the constructs such as selection, repetition, functions and aggregated data .
3. Develop applications in modular approach with classes/modules.
4. Develop solutions to the problems using exception handling.
5. Build packages for simple real world problems and use libraries/packages for graphics and plotting.

Unit-I
Introduction to Object Oriented Programming: Computer Programming and Programming Languages, Generations of Programming Languages, Programming Paradigms, Features of Object Oriented Programming, Merits and Demerits of OOPs
Basics of Python Programming: Features of Python, Variables, Identifiers, Datatypes, Input/ Output operations, Operators and Expressions, operations on strings, Type conversion.

Unit-II
Decision Control Statement: Selection/Conditional Branching, Loop Control Structures, Nested loops.
Functions and Modules: Uses of functions, Function definition, function call, Variable scope and Lifetime, Recursion, Lambda functions, Recursive Functions, Modules, Packages.

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

Unit-IV
Inheritance: Introduction, Inheriting classes, Polymorphism and method overloading, Composition or Containership, Abstract classes and inheritance. **Operator Overloading**: Introduction, Implementation of Operator Overloading, Overriding.
File Handling: File types, opening and closing files, reading and writing files, file positions.

Unit-V
Error and Exception Handling: Introduction, to errors and exceptions, Handling Exceptions Simple GUI Programming with tkinterpackage, Sample Graphics using Turtle, Plotting Graphs in Python.

Text Books:
1. ReemaThareja "Python Programming", Oxford Press, 2017.
2. Mike McGrath "Python in easy steps: Makes Programming Fun", Kindle Edition,2017.

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

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18EG C01

ENGLISH

(Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	20 Marks
Credits	2

Course Objectives: The objectives of this course are

1. To enable the students to understand the role and importance of communication and to develop their basic communication skills in English.
2. To equip the students with basics of writing correct sentences to coherent paragraphs.
3. To equip the students with techniques of writing a précis and an essay by using accurate grammar and appropriate vocabulary.
4. To train the students to describe, define and classify processes and to draft formal reports by adhering to the proper structure.
5. To develop the reading skills and reading comprehension techniques of the students.

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

1. The students will understand the nature, process and types of communication and will communicate effectively without barriers.
2. The students will write correct sentences and coherent paragraphs.
3. The students will know how to condense passages by writing précis and write essays by using accurate grammar and appropriate vocabulary.
4. The students will demonstrate advanced writing skills by drafting formal reports.
5. The students will apply their reading techniques and analyze reading comprehension passages.

UNIT - I

Understanding Communication in English:

Introduction, nature and importance of communication.Process of communication.Basic types of communication - verbal and non-verbal.Barriers to communication.Intrapersonal and interpersonal communication.Johari Window

Vocabulary and Grammar: The concept of Word Formation. Importance of proper punctuation.Articles.

UNIT - II

Developing Writing Skills I:

Types of sentences.Use of phrases and clauses in sentences.Cohesion and coherence. Paragraph writing. Organizing principles of paragraphs in documents. **Vocabulary and Grammar:** Cohesive devices. Root words from foreign languages and their use in English. Prepositions.

UNIT- III

Developing Writing Skills II:

Techniques for writing precisely. Précis Writing. Essay Writing.

Vocabulary and Grammar: Subject-verb agreement, Noun-pronoun agreement Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Redundancies, Clichés.

UNIT - IV

Developing Writing Skills III:

Describing, Defining, Classifying, Providing examples or evidence.Writing introduction and conclusion.

Report writing – Importance, structure and elements of style of formal reports.

Vocabulary and Grammar: Misplaced modifiers. Synonyms, antonyms.

UNIT - V

Developing Reading Skills:

The reading process, purpose, different kinds of texts.Reading comprehension. Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.

Vocabulary and Grammar : Words often Confused. Standard abbreviations

Text Books:

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

Suggested Readings:

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

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18PY C02

OPTICS AND SEMICONDUCTOR PHYSICS LABORATORY

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

Course Objectives: The objectives of this course are
1. Apply theoretical physics knowledge in doing experiments.
2. Understand the behavior of the light experimentally.
3. Analyze the behavior of semiconductor materials and optoelectronic devices.

Course Outcomes: On Successful completion of the course, students 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. Understand the applications of semiconductor materials.
4. Know the working of optoelectronic devices.
5. Use LCR circuits in different applications.

List of Experiments:
1. Error analysis - Estimation of errors in the determination of time period of a torsional pendulum.
2. Hall effect – Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen.
3. Thermistor – Determination of temperature coefficient of resistance of given thermistor.
4. Solar cell - Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance.
5. P-N junction diode – Study of V-I characteristics and calculation of resistance of given diode in forward and reverse bias.
6. Energy gap – Determination of energy gap of given semiconductor.
7. Planck's constant – Determination of Planck's Constant using photo cell.
8. I-V characteristics of LED.
9. Photodiode.
10. Laser – Determination of wavelength of given semiconductor red laser.
11. Newton's rings - Determination of wavelength of given monochromatic source.
12. Diffraction grating – Determination of wavelengths of two yellow lines of mercury light.
13. LCR circuit (Resonance).

Suggested Readings:
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.
4. Indu Prakash, Ram Krishna and A.K. Jha, A Text Book of Practical Physics, Kitab Mahal Publications, 2012.

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18CS C04

OBJECT ORIENTED PROGRAMMING LAB

Instruction	4 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives: The objectives of this course are

1. Identification and installation of required software to work with Python.
2. Program development using OOPs concepts.
3. Handling of errors in program code.
4. Use of library modules to develop GUI applications.

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

1. Set up programming environment to work with Python.
2. Chose appropriate control constructs, data structures to implement the solutions. Design and develop solutions in to the modular approach using OOPs concepts.
3. Debug programs to verify and validate one code.
4. Use of STLs and modules for graphics and plotting.
5. Design and develop solutions to the problems in modular approach using OOPs concepts.

Lab experiments:

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

Text Book:

1. Reema Thareja "Python Programming", Oxford Press, 2017.

Suggested Reading:

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

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18ME C02

WORKSHOP/ MANUFACTURING PRACTICE

Instruction	1T+4P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	3

Course Objectives: The objectives of this course are

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

Course Outcomes – (Laboratory): On Successful completion of the course, students will be able to

1. Fabricate components with their own hands.
2. Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. Assembling different components, student will be able to produce small mechanisms/devices of their interest.
4. Gain practical skills of carpentry, tinsmithy, fitting, house wiring.
5. Gain knowledge of different Engineering Materials and Manufacturing Methods and Understand trades and techniques used in Workshop and chooses the best material/ manufacturing process for the application

List of Exercises

CYCLE 1

Exercises in Carpentry

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

Exercises in Tin Smithy

4. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
5. To make a scoop.
6. To make a pamphlet box.

Exercises in Fitting

7. To make a perfect rectangular MS flat and to do parallel cuts using Hack saw
8. To make male and female fitting using MS flats-Assembly1
9. To make male and female fitting using MS flats-Assembly2

Exercises in House Wiring

10. 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
11. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs.Wiring of two light points connected in parallel from two single pole switches and a three pin socket
12. Stair case wiring-wiring of one light point controlled from two different places independently using two 2-way switches.

CYCLE 2

Exercises in Casting

1. Green sand moulding practice for a single piece pattern
2. Green sand moulding practice for a split pattern with a horizontal core
3. Melting and Pouring of Aluminium
4. Study and Demonstration of Injection moulding

Exercises in Welding

5. Study of gas welding equipment and process. Identification of flames, making Butt joint with gas welding.
6. Study of Arc welding process, making Butt joint with DCSP, DCRP
7. Study of Arc welding process, making Lap joint with A.C
8. Study of resistance welding process and making Lap joint with spot welding

Exercises in Machine shop

9. Introduction to Machine Tools, like Lathe, Drilling, Milling and Shaper
10. Plain and step turning operations on Lathe
11. Step turning and Knurling on Lathe machine
12. Taper turning on Lathe

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Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”,4th edition, Pearson Education India Edition, 2002.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu,”Manufacturing Technology – I” Pearson Education, 2008.
2. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
3. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House,2017.

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18EG C02

ENGLISH LAB

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

Course Objectives: The objectives of this course are
1. To 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. The students will enhance their listening skills by practicing IELTS and TOEFL material.
5. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.

Course Outcomes: On Successful completion of the course, students will be able to
1. Differentiate the speech sounds in English.
2. Interact with the software and understand the nuances of pronunciation in English.
3. Speak with the proper tone, intonation and rhythm and apply stress correctly. The students will demonstrate their listening skills by analyzing the IELTS and TOEFL listening comprehension texts.
4. Speak with clarity and confidence.
5. Work in teams and discuss various topics and demonstrate their presentation skills through posters.

Exercises
1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – practice with IELTS and TOEFL material
6. **Situational dialogues and role play** – Dialogue writing, – Role behavior and role enactment.
7. **Group Discussions** - Dynamics of a group discussion, group discussion techniques, body language.
8. **Public speaking** – Speaking with confidence and clarity in different contexts on various issues.
9. **Poster presentation** – Theme, poster preparation, team work and presentation.

Suggested Reading

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

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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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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**

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%.

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.

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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-ll

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, 4^{th} 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", 7^{th} 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", 2^{nd} 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	PO10	PO11	PO12	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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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**

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%.

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

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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", 8^{th} 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 .

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UNIT - V

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, 3^{rd} Pearson Education.
2. Programming the World Wide Web -Robert W. Sebesta, 4^{th} Pearson Education .

Suggested Reading:

1. Web Programming, building internet applications, Chris Bates 2^{nd} 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", 5th Edition,McGraw Hill Education Edition 2011.
2. Yu-chengLiu, Glenn A.Gibson, "Microcomputer Systems: The 8086/8088 Family", 2nd Edition, PHI Learning 2011.

Suggested Reading:

1. M. M. Mano, "Computer System Architecture", 3rd Prentice Hall,
2. William Stallings, "Computer Organisation and Architecture, Design for Performance", Pearson, 9th Edition, 2013.
3. Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata Mc Graw Hill, Revised 2nd 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", 4th 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", 2nd Edition, PHI Learning 2011.
2. Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata Mc Graw Hill, Revised 2nd 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", 4th Edition, Prentice Hall, 1993.sss

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Choice Based Credit System (CBCS)

Name of the Programme (UG):

B.E Syllabus for Semester V and VI - Semester

With effect from 2018 - 2019

Specialization /Branch: Computer Science and Engineering

Chaitanya Bharathi Institute of Technology (A)

Chaitanya Bharathi (P.O), Gandipet

Hyderabad-500075, Telangana State.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

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

SEMESTER-V

Sl.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16CSC17	Design and Analysis of Algorithms	3/1	-	3	30	70	3
2	16CSC18	Automata Languages and Computation	3/1	-	3	30	70	3
3	16CSC19	Operating Systems	3	-	3	30	70	3
4	16CSC20	Data Communication and Computer Networks	3	-	3	30	70	3
5	16CSC21	Software Engineering	3	-	3	30	70	3
6	16CSE 04/05/06	Elective - II	3	-	3	30	70	3
PRACTICALS								
7	16CSC22	Operating Systems Lab	-	3	3	25	50	2
8	16CSC23	Data Communication and Computer Networks Lab	-	3	3	25	50	2
9	16CSC24	Software Engineering Lab	-	3	3	25	50	2
TOTAL			20	9	-	255	570	24

Elective-II:
16CSE 04 - Mobile Application Development
16CSE 05 - Computer Graphics
16CSE 06 - Advanced Computer Architecture

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

16CSC17 **DESIGN AND ANALYSIS OF ALGORITHMS**

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

Course Objectives:
1. To provide an introduction to formalisms to 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. Describe asymptotic notation used for denoting performance of algorithms.
2. Analyze the performance of a given algorithm and denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms.
3. List and describe various algorithmic approaches.
4. Solve problems using divide and conquer, greedy, dynamic programming, backtracking and branch and bound algorithmic approaches.
5. Apply graph search algorithms to real world problems.
6. Demonstrate an understanding of NP- Completeness theory and lower bound theory

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

UNIT-I
Introduction: Notation for Algorithm Specification, Insertion sort specification and analysis
Growth of functions: Asymptotic notation, standard notation and common functions.
Recurrences: The substitution method, the recursion-tree method, the Master method
Set representation: Simple UNION and FIND, Weighted Union and collapsing Find.

UNIT-II
Divide-and Conquer: The general method, specification and analysis of: finding maximum minimum of a set of values, quick sort, merge sort, Strassen's Matrix multiplication:
Greedy Method: The general method, Knapsack problem, Optimal Storage on tapes, Job sequencing with deadlines, Optimal merge patterns, Huffman codes.

UNIT-III
Dynamic Programming: The general method, Multistage graph, Floyd-Warshall algorithm, Bellman-Ford algorithm, Optimal Binary Search trees, 0/1 Knapsack, Traveling Salesman Problem, Matrix-Chain multiplication and Longest Common Subsequence.

UNIT-IV
Backtracking: The general method,8-Queens Problem, Sum of subsets, Graph Coloring, Hamiltonian cycle, 0/1 Knapsack Problem
Branch and Bound: The general method, Least cost search, control abstraction for LC-Search, Bounding, FIFO branch and bound,LC branch and bound, 0/1 knapsack problem, Traveling salesperson problem.
Depth first Search: Bi-connected components, topological sorting, strongly connected components.

UNIT-V
Lower Bound Theory: Comparison trees for searching and sorting
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.
3. Aho, Hopcroft, Ulman, "The Design and Analysis of Computer Algorithms", Pearson Education, 2000.

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

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16CSC18 AUTOMATA LANGUAGES AND COMPUTATION

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 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. Identify the fundamental Concepts of automata theory and discuss about the various levels of Chomsky hierarchy
2. Define regular expressions, grammars and Design automata for different languages
3. Define the regular, closure and decision Properties of the language and prove the membership
4. Examining the key properties of formal languages and automata by performing prove and disprove theorems
5. Demonstrate the principles behind the basic abstract computing model and its variants
6. Distinguish decidability and un decidability problems and variants of language models

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

UNIT-I

Automata: Introduction to Chomsky's Hierarchy, The need to study automata theory, Central Concepts of Automata Theory.

Finite Automata: An Informal Picture of Finite Automata, Deterministic Finite Automata, Non-deterministic Finite Automata, Finite automata for text search, 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: Pumping Lemma for regular languages, Closure properties of Regular Languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata.

UNIT-III

Context Free Grammars and Languages: Context free grammars, Parse Trees, Right Linear and Left Linear Grammars, Applications of CFGs, Ambiguity in Grammars and Languages.

Pushdown Automata: Definition of the Pushdown Automaton, Languages of PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.

UNIT-IV

Properties of Context Free Languages: Normal Forms for Context Free Grammars, Pumping Lemma, Closure Properties of CFLs, Decision Properties of CFLs. LR(0) grammars, LR(0) and DPDA, LR(k) grammars.

UNIT-V

Introduction to Turing Machines: Problems that Computers cannot Solve, The Turing machines, Programming Techniques for Turing Machines, Extensions to the basic Turing Machine, Restricted Turing Machines, Turing machines and Computers.

Un-decidability: A language that is not Recursively Enumerable, An undecidable problem that is recursively enumerable, Undecidable problems about Turing Machines, Post's Correspondence Problem, Other Undecidable Problems.

. Text Book:

1. John. E. Hopcroft, Rajeev Motwani, Jeffery, D. Ullman, "Introduction to Automata Theory, Languages and Computation", 3rd edition, Pearson Education, 2008.

Suggested Readings:

1. John C.Martin, "Introduction to Languages and the Theory of Computation", 3rd edition Tata McGraw Hill, 2007.
2. Mishra and Chandrashekaran, "Theory of Computer Science – Automata languages and computation", 3rd edition, PHI,2008.

16CSC19 **OPERATING SYSTEMS**

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits 6	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. To develop the knowledge of the role of operating system and its design
2. To implement the knowledge of multiprogramming, multithreading, deadlocks.
3. To analyze the concept of IPC and resource sharing among the users.
4. To understand of memory management including virtual memory.
5. Analyze various Disk scheduling algorithms and I/O operation implementation techniques
6. Familiar with security mechanisms and understand the features of Linux and Windows Operating systems

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

UNIT-I

Introduction: Definition, Operating System Structure, Operating System Services, System Calls, System programs, Operating System Design and Implementation.

Processes & Threads: Process concept, Process Scheduling, Inter-process communication, Threads, Multithreading Models.

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiprocessor scheduling.

UNIT-II

Memory Management: Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with Paging.

Virtual memory: Demand paging, Page replacement Algorithms, Allocation of Frames, Thrashing.

File System Interface: File Concept, Access Methods, Directory and Disk Structure, File System Mounting.

File System Implementation: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free Space management.

UNIT-III

Process synchronization: Critical Section problem, Synchronization Hardware, Semaphores, Classical problems of Synchronization, Monitors

Deadlocks: System model, Deadlock Characterization, Methods for handling deadlocks, Prevention, Avoidance, Detection, Recovery from Deadlock.

UNIT-IV

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

I/O System: I/O hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O request to hardware operation, Streams, Performance.

UNIT-V

Protection: Goals of Protection, Domain of protection, Access matrix, Implementation of Access matrix.

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

Case Studies: Linux System: Design Principles, Kernel Modules, Process Management, Network Structure, And Security. Windows - Design Principles, Architecture, Environmental Subsystem.

Text Books:
1. AviSilberchatz, Peter B. Galvin, Greg Gagne, "Operating System-Concepts", John Wiley & sons, 9th Edition, 2016

Suggested Reading:
1. Andrew S. Tanenbaum, "Modern Operating Systems", 2nd Edition (2001), Pearson Education, Asia
2. W. Richard Stevens; Stephen A. Rago, "Advanced Programming in the UNIX Environment", Third Edition, Addison-Wesley professional Publication Date:14-MAY-2013
3. Dhananjay, Dhamdhere.M, Operating System-concept based approach, 3rd edition (2009), Tata McGraw Hill, Asia

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16CSC20 DATA COMMUNICATION AND COMPUTER NETWORKS

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

Course Objectives:
1. Understanding the concepts of data communications
2. Understanding the concepts of network reference models
3. Analysis of routing algorithms and congestion control algorithms
4. Functionality of the transport layer
5. Understand different application layer protocols

Course Outcomes:
1. Understand the communication protocol suites like ISO-OSI and TCP/IP.
2. Understand and explain Data Communications System and its components
3. Identify and evaluate various routing algorithms, congestion control algorithms.
4. Identify and use internet protocols like IP, ARP, ICMP, IGMP, BGP, OSPF, and DHCP etc.
5. Know the working of transport layer protocols like TCP, UDP, RTCP etc.
6. Understand about the applications (like WWW, DNS, email etc.) and the underlying protocols.

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

UNIT-I

Introduction: Data Communication, Network Types, Network Models – Protocol Layering, TCP/IP Protocol Suite, OSI Model, OSI vs TCP/IP

Physical Layer: Transmission Media, Switching

UNIT-II

Data Link Layer:DLL design issues, Error detection and correction, elementary data link protocols, sliding window protocols, Multiple access protocols

LAN: Wired LAN, Wireless LAN, Connecting devices and Wireless LAN

UNIT-III

Network Layer: Network layer design issues, Routing algorithms, congestion control algorithms, Quality of service, Internetworking, Network layer in the internet

UNIT-IV

Transport Layer : Elements of transport protocol, congestion control, TCP, UDP

UNIT-V

Application Layer :WWW and HTTP, FTP, Email, TELNET, SSH, DNS

Multimedia : Compression, Multimedia data, Multimedia in the internet, Real-time interactive protocols

Text Books:

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

Suggested Reading:

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

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16CSC21 **SOFTWARE ENGINEERING**

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

Course Objectives:

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

Course Outcomes :

1. Assessment in each module gives the overall Software engineering practice
2. Demonstrate the necessary skills to enhance the software project management
3. Understand the systematic methodologies involved in SE
4. Understand design and develop a software product in accordance with SE principles

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

UNIT-I

Introduction to Software Engineering: The nature of Software, Software Engineering, The Software Process, software Engineering Practice.

Process Models: A Generic Process Model, Process Framework, CMMI, Prescriptive Process Models: Waterfall Model, Incremental Process Models, Evolutionary Process Models – Prototyping, The Spiral Model, ConcurrentModels;

An agile view of Process: Agility, Agile Process and Agile Process Models –Extreme Programming (XP), Adaptive Software Development(ASD).

UNIT-II

Requirement Engineering – Understanding Requirements : Establishing the Groundwork, Requirement Engineering tasks, Initiating the Requirements Engineering Process, Eliciting Requirements, Feasibility Study,

Software RequirementsAnalysis and Specification: Software Requirements, Problem Analysis, Requirements Specification, Decision Tables, SRS Document, IEEE standards for SRS, Case Studies

Planning and Managing the project: Managing Software Project, Project Personnel, Effort Estimation, Risk Management, the project plan, Software project estimation – Empirical estimation models.

UNIT-III

Design Engineering: Design Principles, Design Notation and Specification, Design concepts, Flow oriented modeling; The function-oriented design for the case studies; OO Design Concepts; Modeling Component-Level Design,

Architectural Design: Software Architecture, Data Design, A brief Taxonomy of Architectural Styles.

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

UNIT-IV

Testing Strategies: A strategic approach to software testing, strategic issues, test strategies for Conventional and OO Software, Validation Testing, System Testing, Art of Debugging.

Testing Tactics: Software Testing Fundamentals, White Box Testing: Basis Path Testing, Control Structure Testing, O-O Testing methods. Black Box.Software quality.

UNIT-V

Software Quality Assurance – Managing Software Project, Quality concepts, Software Quality Assurance Software Reviews, Technical Reviews, Software reliability;

Software Configuration Management: Identification of Objects in the Software Configuration, Configuration Audit, SCM Standards

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

Text Books:

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

16CSE04 MOBILE APPLICATION DEVELOPMENT

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

Course Objectives

1. Understand J2ME and Android architecture and solve problems with J2ME, Android application
2. Design, implement and evaluate a User Interface for a mobile application .
3. Understand how to create working mobile application for small computing devices uisng Android.
4. Understand to manage repository of data information for mobile application
5. Categories the challenges posed by developing mobile applications and able to propose and evaluate and select appropriate solutions.

Course Outcomes

1. Ability to evaluate and select appropriate solutions to the mobile computing platform.
2. Ability to develop the user interface.
3. Ability to develop database management system to retrieve data for mobile application
4. Ability to build a simple mobile application.
5. Develop and Deploy mobile applications

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

UNIT- I

Developing for Mobile and Embedded Devices, J2ME Overview: Java 2 Micro Edition and the World of Java, Inside J2ME, J2ME and Wireless Devices.

J2ME Architecture and Development Environment: J2ME Architecture, Small Computing Device Requirements, Run-Time Environment, MiDlet Programming, J2ME Software Development Kits, Multiple MIDlets in a MIDlet Suite.

UNIT-II

Commands, Items, and Event Processing: J2ME User Interfaces, Display Class, Command Class, Item Class, Exception Handling

Record Management System: Record Storage, Writing and Reading Records, Record Enumeration, Sorting Records, Searching Records, Record Listener

UNIT- III

Generic Connection Framework: The Connection, Hypertext Transfer Protocol, Communication Management Using HTTP Commands, Session Management, Transmit as a Background Process

Android: An Open Platform for Mobile Development, A Little Background, Native Android Applications, Android SDK Features, Developing for Android, Android Development Tools

UNIT- IV

Creating Applications and Activities:Introducing the Application Manifest File, Externalizing Resources, The Android Application Lifecycle, A Closer Look at Android Activities,

Building User Interfaces:Fundamental Android UI Design, Android User Interface Fundamentals, Introducing Layouts

UNIT- V

Databases and Content Providers: Introducing Android Databases, Working with SQLite Databases, Creating Content Providers, Using Content Providers, Adding Search to Your Application

Text Books:

1. J2ME: The Complete Reference, James Keogh, Tata McGrawHill, 2017.
2. Professional Android Application Development, Reto Meier, Wiley India, 2012.

Suggested Reading:

1. Mobile Design and Development, Brian Fling, O'Reilly, SPD, 2011.
2. Beginning Android Application Development, Wei-Meng Lee, Wiley Publishing, Inc, 2012
3. Android a Programming Guide, Jerome(J.F.) DiMarzio, McGrawHill, 2010
4. https://onlinecourses.nptel.ac.in/noc16_cs13
5. https://developer.android.com/index.html

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16CSE05 COMPUTER GRAPHICS

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 Identify and explain the core concepts.
2. To Acquire knowledge about device level algorithms for displaying two dimensional output primitives for raster graphics system.
3. To Acquire knowledge about the basic concepts of representing 3D objects in 2D.
4. To Introduce computer graphics techniques transformations, clipping, curves and surfaces.

Course Outcomes:
1. Review the core concepts of computer graphics.
2. Analyse graphics techniques for rasterization, clipping, curve generation etc.
3. Evaluate pictures using various algorithms.
4. Understand the pipeline of typical graphics
5. Interpret and apply relevant problem solving methodologies

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

Prerequisites:
Knowledge of Linear Algebra (vectors and matrices), Good programming skills

UNIT-I
Graphics Systems and Models: Graphics system; Images; Physical and synthetic; Imaging system; synthetic camera model; programming interface ; graphics architectures programmable pipelines; performance characteristics.
Graphics Programming: Programming two-dimensional applications; OpenGL API; Primitives and attributes; color; viewing, control functions

UNIT-II
Input and Interaction: Input device; clients and servers; displays lists; display lists and modeling; programming event driven input; picking ; building interactive models; animating Interactive programs; logic operations.
Geometrics Objects: Three - dimensional primitives; coordinates systems and frames; frames in OpenGL; Modeling colored cube.

UNIT-III
Transformations: Affine Transformations; Transformations in homogenous coordinates; concatenation of Transformations; OpenGL transformation matrices; **Viewing:** Classical and Computer views; Viewing with a computer; Positioning of camera; Simple projections; Projections in OpenGL; Hidden surface removal; Parallel-projection matrices; Perspective projection matrices

UNIT-IV
Lighting and Shading: Light sources; The Phong lighting model; Computational vectors; Polygonal shading; Light sources in OpenGL; Specification of matrices in OpenGL; Global illumination;
From Vertices To Frames: Basic implementation strategies; line-segment clipping; polygon clipping; clipping of other primitives; clipping in three dimensions; Rasterization ; Bresenham's algorithm; Polygon Rasterization ; Hidden surface removal; anti-aliasing; display considerations.

UNIT-V
Modelling & Hierarchy: Hierarchal models; trees and traversal; use of tree data structure; animation; Graphical objects; Scene graphs; Simple scene graph API; Open Scene graph; other tree structures;
Curves and Surfaces: Representation of curves and surfaces; design criteria; Bezier curves and surfaces; Cubic B-splines; General B-splines; rendering curves and surfaces; curves and surfaces in OpenGL.

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Text Books:

1. Edward Angel ,Computer Graphics A Top-Down Approach with shader based openGL, Peasrson Education, 6^{th} edition -2011.
2. Hearn Donald, Pauline Baker M: Computer Graphics with openGL, 4^{th}edition ,Prentice Hall PTR, 2010.
3. **Fransis S Hill Jr., Stephen M Kelley, Computer Graphics Using OpenGL, Prentice**-Hall Inc., 3^{rd} edition , 2007.
4. Edward Angel ,Computer Graphics A Top-Down Approach using openGL, Peasrson Education, 5^{th} edition -2009.
5. Jim X. Chen, Foundation of 3D Graphics Programming Using JOGL and Java3D, Springe Verlag, 2006.
6. Hearn Donald, Pauline Baker M: Computer Graphics, 2^{nd}edition ,Prentice Hall PTR, 1995.

Online Resources:

1. http://nptel.ac.in/courses/106106090/
2. http://nptel.ac.in/courses/106102065/

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16CSE06 ADVANCED COMPUTER ARCHITECTURE

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 provide concepts on performance measurement of processor architectures
2. To provide knowledge about the need of parallel processing
3. To provide basics about parallelism techniques implemented in uniprocessor technologies.
4. To gain knowledge of state-of-the art technologies like superscalar and vector processor
5. To gain knowledge on multiprocessor and multi-core technologies.

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Course Outcomes:
1. Acquire skills to measure the performance of various processor architectures
2. Apply parallel processing techniques
3. Gain knowledge on parallelism techniques implemented in uniprocessor technologies.
4. Understand the state-of-the art technologies like superscalar and vector processor
5. Gain knowledge multiprocessor and multi-core technologies.
6. Understand the parallel program development.

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

UNIT-I

Measuring Performance and cost: Performance measurement, Enhancements to Uniprocesssor 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, and Programming Vector processors.

Array Processors: Parallel array processor model, and Memory organization Interconnection networks: performance measures, static and dynamic topologies

UNIT-IV

Multiprocessors and Multi computers: Multiprocessor models, Shared-memory and Distributed memory architectures, Memory organization, Cache Coherence and Synchronization Mechanisms, Parallel computer, and Performance models.

UNIT-V

Software for parallel Programming: Parallel models, languages, and compilers, Parallel Program Development and Environments, and Trends in Parallel systems- Heterogeneous Computing multi-core architectures, and Asymmetric multi-core architectures.

Text Books:
1. John L. Hennessey and David A. Patterson , "Computer Architecture, A QuantitativeApproach ", 4 th Edition, Elsevier, 2007.

Suggested Reading:
1. Sajjan G. Shiva, "Advance Computer Architecture ", Taylor Series Group, CRC press, 2006.
2. Kai Hwang and Naresh Jotwani, "Advanced Computer Architecture", Mc Graw Hill, 1999.

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16CSC22 **OPERATING 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 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. To use Unix utilities and perform basic shell control of the utilities
2. To use the Unix file system and file access control.
3. To write programs systems based on multiple cooperating processes or threads
4. To implement process scheduling, synchronization and memory management algorithms.
5. To implement process synchronization problems
6. To implement process deadlocks.

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

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.

Text Books:
1. Deitel and Deitel, "Operating System", Pearson Education, New Delhi, Third Edition, 2007.

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16CSC23 DATA COMMUNICATION AND COMPUTER 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:
1. Understand different types of network medium and devices
2. Learn basic network commands
3. Installation and working of simulation tools
4. Performance measurement of network
5. Create network topologies using simulation tools

Course Outcomes:
1. Become familiar with different types of equipment and cables used in the networks lab
2. Identification of various network devices
3. Familiarity of basic network commands
4. Ability to assign an IP address to a PC
5. Ability to connect a PC to the LAN
6. Design network topologies using simulation tools

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

List of Experiments:
1. Study of Network medium and devices
2. Study of basic network commands and configuration tools (ifconfig, ping, traceroute, nslookup,dig,arp,netstat, nmap etc.,)
3. Introduction to Network Simulation tools and Installation of any one tool
4. Simulation of a simple network with three nodes and identifying as a central node
5. Study and simulationany two topologies
6. Simulation of a network with multiple routers and nodes by using hybrid topology
7. Installation and configuration of NetAnim
8. Implementation of FTP using TCP bulk transfer
9. Calculationof the performance for the network implemented in experiment 6
10. Analysisof network traces using wireshark or any tool

Text Books:
1. https://www.nsnam.org/docs/release/3.18/tutorial/ns-3-tutorial.pdf

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16CSC24 SOFTWARE ENGINEERING 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 identify Project Scope, Objectives and infrastructure.
2. To understand Software Engineering methodologies for project development
3. To gain knowledge about Computer Aided Software Engineering (CASE) tools.
4. To use effective communication skills and technical skills to assure production of quality software.

Course Outcomes:
1.Identify the problem scope and constraints of the problem.
2.Prepare the requirements specification for the system to be developed according to IEEE standards.
3.Apply the design notations of structured approach to develop ER and Data Flow Diagrams.
4.Apply/Use the design notations of Object-oriented approach to develop UML diagrams using Rational tools.
5. Develop the Test cases to validate the proposed system.
6. Analyze the implementation and prepare the documentation for the proposed system.

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

A group of five students are identified as a team and the team should be able to develop mini project on the case studies like:
(i) Online Library Management system in college.
(ii) Online Feedback system in college.
(iii) Online Leave Management System for staff in college
(iv) Online Attendance Management system in college.
(v) Online Canteen Management System in college.

The team need to do the following experiments to develop the mini project.

Week 1: Introduction to Software product Development and Tools.
Week 2: roblem Definition
Week 3: Software Requirement Specification-Standard IEEE SRS document.
Week 4: Data dictionary
Week 5,6: System Design-structural diagrams, UML diagrams
Week 7,8: Implementation using Computer Aided Software Engineering tools(CASE).
Week 9: Generating Test Cases
Week 10: Document Writing.

Text Books:
1. Grady Booch, James Rumbaugh, Ivar Jacobson : The Unified Modeling Language User Guide, Pearson Education, 2007
2. Roger S. Pressman, “Software Engineering –A Practitioners Approach”, 7th Edition, Pearson Education, India, 2010

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION
VI-Semester of B.E under CBCS
COMPUTER SCIENCE AND ENGINEERING

SEMESTER-VI

Sl.No	Syllabus Ref. No	SUBJECT	Scheme of Instruction		Scheme of Examination			Credits
			Periods per Week		Duration Credits of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16CSC25	Compiler Construction	3	-	3	30	70	3
2	16CSC26	Artificial Intelligence	3	-	3	30	70	3
3	16CSC27	Mobile Computing	3	-	3	30	70	3
4	16CSC28	Information and Network Security	3	-	3	30	70	3
5	16CSC29	Internet of Things	3	-	3	30	70	3
6	16CSE 07/08/09	Elective-III	3	-	3	30	70	3
PRACTICALS								
7	16CSC30	Information and Network security Lab	-	3	3	25	50	2
8	16CSC31	Internet of Things Lab	-	3	3	25	50	2
9	16CSC32	Mini Project-II	-	3	3	50	-	1
		TOTAL	18	9	-	280	520	23

Elective-III:
16CSE07 – Computer Vision
16CSE08 – Soft Computing
16CSE09 – Data Mining

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

16CSC25 COMPILER CONSTRUCTION

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 implement the concept learned in automata theory and languages to the field of Computer Science.
2. Analyze the basic steps involved in converting a source language to target code.
3. Understands the concepts of parsers and can write solutions for various grammars by using tools, and also analyzes different storage techniques, error recovery strategies.
4. Gain the knowledge to write a compiler program or can able to build a compiler.

Course Outcomes:
1. Identify the basic concepts needed for the development of a compiler
2. Analyze the various phases and Tools of a Compiler
3. Describe the differences between Top down and Bottom up Parsers and apply parsing methods for various grammars.
4. Compare and Contrast Symbol table organization for Block structured and non-Block structured languages.
5. Analyze the concepts involved in Intermediate, code generation and Code Optimization Process.
6. Recognize the various types of errors and error recovery strategies in phases of Compilation.

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

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, Brute Forcing, Recursive Descent, Predicative LL(1), Bottom-Up parsing : Introduction to LR Parsing, Powerful LR parsers SLR, CALR, LALR, Using Ambiguous Grammars,
Parser Generators - YACC.

UNIT-III

Syntax Directed Translation – Syntax Directed Definitions. Evaluation Orders for SDDs. Applications of Syntax Directed Translation.
Symbol Table Organization - Structure of Symbol table, Symbol Table organization for Block Structured and non-block Structure languages, Data Structures of symbol Table.

UNIT-IV

Intermediate code generation: Variants of syntax trees. Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow.
Storage Organization.Stack, Heap Management, 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.

UNIT-V

Machine Independent Optimizations – The Principal Sources of Optimizations, Introduction to data flow analysis, Foundation of data flow analysis.
Error Recovery : Error detecting and Reporting in various Phases.
Introduction to Advanced Topics : Review of compiler structure, advanced issues in elementary topics, the importance of optimizations, Structure of optimizing compilers

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Text Books:
1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, “Compilers: Principles Techniques & Tools”, Pearson Education 2nd Edition 2013.
2. Muchnik, “Advanced Compiler Design and Implementation”, Kauffman(1998)

Suggested Reading:
1. Kenneth C Louden, “Compiler Construction: Principles and Practice”, Cengage Learning. Lex &Yacc, John R Levine, Oreilly Publishers.
2. Keith D Cooper & Linda Tarezon, “Engineering a Compiler”, Morgan Kafman, Second edition. Lex &Yacc, John R Levine, Tony Mason, Doug Brown, Shroff Publishers.

Online Resources:
1. http://www.nptel.ac.in/courses/106108052
2. https://web.stanford.edu/class/archive/cs/cs143/cs143.1128/
3. http://en.wikibooks.org/wiki/Compiler_Construction
4. http://dinosaur.compilertools.net/
5. http://epaperpress.com/lexandyacc/

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16CSC26 **ARTIFICIAL INTELLIGENCE**

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 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:
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 using Prolog.

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

UNIT I
Intelligent Agents: Intelligent agents**,** structure of agents
Introduction & Problem Solving: AI problems, AI Technique, Defining problem as a State-Space Search, Production Systems, Problem Characteristics.
Heuristic Search Techniques: Generate–and–test, Hill Climbing, Best–First Search,Problem Reduction, Constraint Satisfaction.

UNIT II
Game Playing: Overview, Min-Max search Procedure, Adding Alpha-beta Cutoffs, AdditionalRefinements, Iterative Deepening.
Using Predicate Logic: Representing simple facts in logic, Representing Instance and ISARelationships, Computable Functions , propositional calculus and predicates, Resolution.

UNIT III
Uncertainty and Reasoning Techniques: Non monotonic reasoning, Logics for Non monotonicreasoning, Implementation issues.
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.
Expert System: Representing and Using Domain Knowledge, Expert systems shells,Explanation, Knowledge Acquisition.

UNIT V
Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis,Statistical NLP, Spell Checking.
PROLOG-The Natural Language of AI: Prolog facts and rules, variables, control structures, arithmetic operators, matching in prolog ,backtracking.

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 Reading:
1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2012.
2. Nelson M. Mattos, "An Approach to Knowledge Base Management", Springer Berlin Heidelberg, 1991.

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

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16CSC27 **MOBILE COMPUTING**

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 impart fundamental concepts in the area of mobile computing
2. To provide a computer systems perspective on the converging areas of wireless networking, embedded systems and software
3. To study the specification and functionalities of various protocols / standards of mobile networks
4. To understand transactions and m-Commerce principles

Course Outcomes:
1. Gain knowledge in the fundamental concepts of mobile computing
2. Understand the principles of wireless transmission and cellular networks
3. Compare various telecommunication systems and broadcasting techniques
4. Identify various wireless LAN and routing protocols for different environments
5. Understand file systems and transaction for mobility support
6. Will have an understanding of social and ethical issues of mobile computing and privacy issues

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

UNIT-I

Introduction: Wireless Transmission, Frequencies for Radio Transmission, Signals, Antennas, Signal Propagation, Multiplexing, Modulations, Spread Spectrum, MAC, SOMA, FDMA, TDMA, CDMA, Cellular Wireless Networks.

UNIT-II

Telecommunication Systems: GSM, GPRS, 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, HIPER LAN.

UNIT-IV

Routing in Ad-hoc Networks: Ad-hoc Network Routing Protocols, Destination Sequenced Distance Vector Algorithm, Cluster Based Gateway Switch Routing, Global State Routing, Fish-eye state Routing, Dynamic Source Routing, Ad-hoc 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, Social Issues, Mobile Privacy and Ethics.

Text Books:
1. Jochen Schiller, *Mobile Communications*, Pearson Education, 2nd Edition, 2009.
2. Kurnkum Garg, *Mobile Computing : Theory and Practice*, Pearson Education , 2010
3. AsokeK Talukder, Roopa R Yavagal, *Mobile Computing*, TMH 2008.

Suggested Reading:
1. Raj Kamal,"*Mobile Computing"*, Oxford University Press, 2nd edition,2014.
2. S. Acharya, M. Franklin and S. Zdonil, "*Balancing Push and Pull for Data Broadcast, Proceedings of the ACM SIGMOD*", Tuscon, AZ, May 1997.
3. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI, 2012
4. "*A Survey of Mobile Transactions appeared in Distributed and Parallel databases*" 16,193- 230, 2004, Kluwer Academics Publishers.

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16CSC28 **INFORMATION AND NETWORK SECURITY**

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

Course Objectives:
1. Deal with the underlying principles of information and network security.
2. To understand the network security, services, attacks, mechanisms, types of attacks on TCP/IP protocol suite.
3. To comprehend and apply network layer security protocols, Transport layer security protocols, Web security protocols.
4. To comprehend and apply authentication services, authentication algorithms
5. Deal with the key exchange problem and solutions using the Diffie-Hellman and Message Authentication Codes (MAC) and signature schemes.

Course Outcomes:
1. Understand the most common type of information and network threat sources.
2. Be able to determine appropriate mechanisms for protecting the network.
3. Design a security solution for a given application, system with respect to security of the system
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.

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

UNIT-I
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.

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, 6th Edition, Cengage Learning, 2017.
2. William Stallings: Cryptography and Network Security, 7th Edition, Pearson Education, 2015.

Suggested Reading:
1. Behrouz A. Forouzan "Cryptography and its principles".

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16CSC29 **INTERNET OF THINGS**

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

Course Objectives:

1. Understand vision and Introduction to IoT.
2. Explore Data and Knowledge Management and use of Devices in IoT Technology.
3. Understand State of the Art – IoT Architecture.
4. Understand IoT protocols.
5. Programming with Raspberry Pi
6. Explore the Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Course Outcomes:

1. Understand the Architectural Overview of IoT
2. Use of Devices, Gateways and Data Management in IoT.
3. Building state of the art architecture in IoT.
4. Understand various protocols used in IoT.
5. Understand Application of IoT in Industrial and Commercial Building Automation.
6. Understand Real World Design Constraints.

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

UNIT-I

Overview: IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. 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-II

IoTReference Architecture: IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - 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.

UNIT-III

IoT Protocols:Infrastructure (ex: 6LowPAN, IPv4/IPv6, RPL), **Identification** (ex: EPC, uCode, IPv6, URIs), **Comms / Transport** (ex: Wifi, Bluetooth, LPWAN), **Discovery** (ex: Physical Web, mDNS, DNS-SD), **Data Protocols** (ex: MQTT, CoAP, AMQP, Websocket, Node), **Device Management** (ex: TR-069, OMA-DM), **Semantic** (ex: JSON-LD, Web Thing Model), **Multi-layer Frameworks** (ex: Alljoyn, IoTivity, Weave, Homekit)

Unit-IV

Raspberry Pi: Exemplary Device: RaspberryPi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python.
NODEMCU (ESP8266) : Introduction and Architecture.

Unit-V

Domain Specific IOTs: Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry.

Text Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, **"**From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence**",** 1st Edition, Academic Press, 2014.
2. ArshdeepBahga, Vijay Madisetti, Internet of Things: A hands on approach, 2014, VPT publishers;

Suggested Reading:

1. Peter Waher**, "**Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI

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2. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
3. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications

Online Resources:

1. https://www.postscapes.com/internet-of-things-protocols/
2. https://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/

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16CSE 07 **COMPUTER VISION**

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 develop algorithms and techniques to analyze and interpret the visible world around us.
2. To understand the Fundamental Concepts Related To Multi-Dimensional Signal Processing,
3. To understand Feature Extraction algorithms
4. To analyze Patterns in images
5. To understand Visual Geometric Modeling
6. To understand Stochastic Optimization

Course Outcomes:
1. To understand concepts necessary in this field, to explore and contribute to research and further developments in the field of computer vision.
2. To apply in the field of Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

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

Unit-I

Introduction to Computer Vision and Image Formation: Introduction, Geometric primitives and transformations,Photometric image formation, Digital Camera image formation.

Image Processing: Point operators , Linear filtering , More neighborhood operators , Fourier transforms , Pyramids and wavelets ,Geometric transformations , Global optimization

Unit-II

Feature detection and matching: Points and patches, Edges ,Lines.

Segmentation: Activecontours ,Split and merge ,Mean shift and mode finding ,Normalized cuts , Graph cuts and energy-based methods.

Feature-based alignment: 2D and 3D feature-based alignment ,Pose estimation Geometric intrinsic calibration

Unit-III

Structure from motion: Triangulation , Two-frame structure from motion , Factorization ,Bundle adjustment , Constrained structure and motion

Dense motion estimation: Translational alignment ,Parametric motion ,Spline-based motion ,Optical flow , Layered motion.

Unit-IV

Recognition : Object detection ,Face recognition , Instance recognition ,Category recognition ,Context and scene understanding ,Recognition databases and test sets

Unit-V

3D reconstruction : Shape from X , Active rangefinding , Surface representations ,Point-based representations, Volumetric representations , Model-based reconstruction ,Recovering texture maps.

Image-based rendering : View interpolation ,Layered depth images , Light fields and Lumigraphs ,Environment mattes ,Video-based rendering

Text Books:

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

References

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

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

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16CSE 08 **SOFT COMPUTING**

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 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. Understand various soft computing techniques.
2. Understand various learning models.
3. Design and develop various Neural Network Architectures.
4. Understand approximate reasoning using fuzzy logic.
5. Analyze and design Genetic algorithms in different applications.
6. Ability to apply soft computing techniques to solve different applications.

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

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, Linearseparability, 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: Kohonenself organizing networks, Adaptive resonance theory.
Associate Memory Networks: Bidirectional associative memory network, Hopfield networks.

UNIT-IV

Fuzzy Logic: Introduction to classical sets and Fuzzy sets, Fuzzy relations, Tolerance and equivalence relations, Membership functions, Defuzzification,

UNIT-V

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

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

Suggested 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.
6. N.P. Padhy and S.P. Simon,"Soft Computing: With Matlab Programming", Oxford University Press, 2015

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

16CSE09 **DATA MINING**

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 understand the principles of Data warehousing and Data Mining
2. To be familiar with the Data Warehouse Architecture and its implementation.
3. Learn how to produce a quantitative analysis report/memo with the necessary information to make decisions.
4. Provide understanding of mathematical concepts and algorithms used in data mining.
5. Identifying business applications of data mining
6. Develop and apply critical thinking, problem-solving, and decision-making skills.

Course Outcomes:
1. Understand the process, issues and challenges of knowledge discovery
2. Identify and analyze the significance and working of various data preprocessing methods.
3. Understand operational database, warehousing, and multidimensional need of data base to meet industrial needs.
4. Explore the concepts of market basket analysis to generate association rules.
5. Analyze and Evaluate the performance of Classification and Clustering algorithms
6. Understand the significance and methodologies of outlier detection Schemes

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

UNIT-I

Introduction: Fundamentals of data mining, Data Mining Functionalities, Issues in Data Mining.
Data Objects and Attribute types, Basic Statistical descriptions of data, Data Visualization, Measuring data similarity and Dissimilarity.
Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT-II

Data Warehouse and Online Analytical Processing: Basic Concepts of Data Warehouse, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Architecture, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.
Data Cube Computation: Preliminary Concepts, Data Cube Computation Methods

UNIT-III

Mining Frequent Patterns, Associations and Correlations: Basic Concepts and Methods, Frequent Item set Mining Methods, Pattern Evaluation Methods: From Association Analysis to Correlation Analysis.

UNIT-IV

Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to improve Classification Accuracy, Classification by Back propagation Prediction, Support Vector Machines, Lazy Learners.

UNIT-V

Cluster Analysis: Basic Concepts and Methods, Partitioning Methods: K-means Technique, Hierarchical Methods: Agglomerative and Divisive, Density Based Methods: DBSCAN technique, Evaluation of Clustering.
Outlier Detection: Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches, Clustering Based Approaches.

Text Books:

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining – Concepts and Techniques”, 3rd edition, Morgan Kaufmann Publishers, ELSEVIER, 2013.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2006.

Suggested Reading:

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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16CSC30 INFORMATION AND NETWORK SECURITY 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. 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:
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.

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

List of Programs:
1. To perform encryption and decryption using the following algorithms
   a. Ceaser cipher b. Substitution cipher c. Hill Cipher
2. Implement the DES algorithm logic in C.
3. Implement the DES algorithm logic in JAVA.
4. 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.
5. Implement the Blowfish algorithm logic
6. Implement RSA algorithm.
7. Implement Message Authentication Code (MAC)
8. Calculate the message digest of a text using the SHA-1 algorithm
9. Calculate the message digest of a text using the MD5 algorithm
10. Explore the Java classes related to digital certificates.
11. Create a digital certificate of your own by using any tool.
12. Create the awareness on open SSL.

Suggested Readings:

1. Michael Gregg "Build Your Own Security Lab", Wiley India.
2. Cryptography and Network Security Principles and Practice, William Stallings, 5th Edition, Prentice Hall,2011
3. Alfred Basta, Wolf Halton, "Computer Security, concepts, issues and implementation: Cengage Learning".

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16CSC31 **INTERNET OF THINGS 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 how sensors are used in IoT systems.
2. To understand how to program on embedded and mobile platforms including ESP8266 and Raspberry-Pi.
3. To understand how to communicate with mobile devices using various communication platforms such as Bluetooth and Wi-Fi.
4. To understand how to make sensor data available on the Internet.
5. To understand how to analyze and visualize sensor data.
6. To understand how to work as a team and create end-to-end IoT applications.

Course Outcomes:
1. Use different types of sensors in various IoT Systems.
2. Use of devices, Gateways and Database Management in IoT.
3. Working with ESP8266 to implement various IoT systems.
4. Working with Raspberry-Pi to implement various IoT Systems.
5. Understand Application of IoT in Agriculture and Industries.
6. Understand Real World Design Constraints.

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

List of Experiments:
1. Implementation of Home Automation System using WiFi Module.
2. Design and develop Rain Sensing Automatic Wiper System.
3. Develop a system to identify accident and send alert messages.
4. Implementation of Traffic Light System based on density, to decrease congestion.
5. Design and develop IoT Solar Power Monitoring System.
6. Design and develop patient health monitoring system.
7. Design and develop IoT based Fire Altering System to give alert message to fire department.
8. Implementation of Smart Agriculture Monitoring System.

Suggesting Reading :
1. ArshdeepBahga, Vijay Madisetti, Internet of Things: A hands on approach, 2014, VPT publishers;

Reference Books:
1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

16CSC32 **MINI PROJECT-II**

Instruction	3 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 Design and Analysis of Algorithms, Automata Languages and Computation, Operating Systems, Data Communication and Computer Networks, Software Engineering, Compiler construction, Artificial Intelligence and Mobile Computing 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 the semester

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WITH EFFECT FROM ACADEMIC YEAR 2016-17

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
					Duration in Hrs.	Maximum Marks		
			L/T	D/P		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 462 Adhoc Sensor Networks
CS 463 Optimization Techniques
CS 464 Open Source Technologies
CS 465 Software Project Management
ME 464 Entrepreneurship

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 473 Semantic Web & Social Networks
CS 475 Human Machine Interaction
CS 472 Cloud Computing
CS 474 Cyber Forensics
CS 476 Software Reuse Techniques

Elective-IV:

CS 481 Pattern Recognition
CS 483 Machine Learning
ME472 Intellectual Property Rights
CS 482 Bio Informatics
CS 484 Business Intelligence
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: Overview, 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.

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WITH EFFECT FROM ACADEMIC YEAR 2016-17

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.

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

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.

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.

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.

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:

WITH EFFECT FROM THE ACADEMIC YEAR 2016 - 2017

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.

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.

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.

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.

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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)

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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.

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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.

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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.

SUGGESTED READINGS:

1. Alfred Basta, Wolf Halton, "Computer Security, concepts, issues and implementation:, Cengage Learning".

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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.

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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

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.

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.

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.

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.

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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.

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.

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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?

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UNIT-III
Trademarks: What is a trademark? Rights of trademark? What kind of signs can be used as trademarks? Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered? How long is a registered trademark protected for? How extensive is trademark protection? What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV
Copyright: What is copyright? What is covered by copyright? How long does copyright last? Why protect copyright? Related Rights: what are related rights? Distinction between related rights and copyright? Rights covered by copyright? Copy rights in computer programming.

UNIT-V
Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.
Unfair Competition: What is unfair competition? Relationship between unfair competition and intellectual property laws?

TEXT BOOKS:

1. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
2. B. L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi 2010

SUGGESTED 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.

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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 (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.

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,

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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.

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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.

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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.

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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)**", 1st Edition, 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.

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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.

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.

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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

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.

Professor and Head Department

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.

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.

Professor and Head Department

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.

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

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.

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

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

Professor and Head Department

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

18MT CO1

MATHEMATICS– I

(Common to all branches and except for Bio-Tech)

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

Course Objectives:

1. To solve linear system of equations using Matrix Methods.
2. To know the convergence of the Series.
3. To represent the function in series form.
4. To know the Partial Derivatives and use them to interpret the way a function of two variables behaves.
5. To learn Vector Differential Operator and its Physical interpretations on Scalars and vector functions.
6. To solve improper integrals.

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 vectors in engineering problems.
2. Check the series convergence.
3. Find the evolutes of the given curves.
4. Expand and find extreme values of functions of two variables.
5. Understanding the significance of gradient, divergence and curl.
6. An ability to solve the problems and interpret in geometrical approach.

UNIT-I: Matrices:

Rank of the matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Eigenvalues, Eigenvectors, Properties of eigenvalues, Cayley-Hamilton theorem, Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic forms.

UNIT-II: Sequences and Series:

Definition of Convergence of sequence and series. Tests for convergence of series: Comparison test, limit comparison test, D'Alembert ratio test, Raabe's test, Cauchy's n^{th} root test, logarithmic test, alternative series, absolute and conditional convergence.

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UNIT-III: Calculus:

Rolle's Theorem, Lagranges Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, radius of curvature, Evolutes and involutes ,
Fourier series, half range sine and cosine series

UNIT-IV: Multi variable Calculus (Differentiation):

Functions of two variables, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions two variables, Lagrange's multipliers method.

UNIT-V: VectorCalculus (Differentiation):

Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, vector identities. Improper integrals: Beta and Gamma functions and their properties

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36^{th} Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9^{th} Edition, John Wiley & Sons, 2006.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill, New Delhi, 11^{th} Reprint, 2010.

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18CY C01

CHEMISTRY

(Common to all Branches)

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

Course Objectives

1. 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.
2. This syllabus helps at providing the necessary introduction of the inorganic chemistry principles and concepts of chemical bonding involved in a comprehensive manner understandable to the students aspiring to become practicing engineers.
3. Thermodynamic and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
5. New materials lead to discovering of technologies in strategic areas like defense and space research for which an insight into nano and composite materials of modern chemistry is essential.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations & Ionic Equilibria.
3. List major chemical reactions that are used in the synthesis of molecules.
4. Apply the various methods used in treatment of water for domestic and industrial use.

5. Discuss the various Engineering materials & Drug synthesis & their applications.

UNIT-I Atomic and molecular structure:

Molecular Orbital theory - atomic and molecular orbitals.Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Energy level diagrams of diatomics (H_2, He_2^+,N_2, O_2, O_2^- , CO, NO). Pi- molecular orbitals of butadiene , benzene and their aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

UNIT-II Use of free energy in chemical equilibria and Ionic Equilibria:

Use of free energy in chemical equilibria : Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy(criteria of spontaneity).Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials –electrochemical series.Nernst equation and its applications. Potentiometric Acid base & Redox Titrations.Numericals.

Ionic Equilibria: Solubility product, Determination of solubility product, Applications of solubility product- Determination of solubilities of sparingly soluble salts; Predicting precipitation reactions; Precipitation of an insoluble salt; Precipitation of soluble salts ; Inorganic analysis .Numericals.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures , Symmetry and chirality, Stereoisomers - Configurational isomers (Geometrical&Optical isomers), Conformational isomers - Newman and sawhorse representations of n-butane ,enantiomers (lactic acid), diastereomers (Tartaric acid) , optical activity, absolute configurations , Sequence rules for R&S notation.

Organic reactions

Types of Organic reactions:

Substitution Reactions- Electrophilic substitution (Nitration of Benzene) ;Nucleophilic Substitution(S_N1& S_N2) ; Free Radical Substitution(Halogenation of Alkanes).

Additions Reactions:

Electrophilic Addition – Markonikoff's rule.

Nucleophilic Addition – (Addition of HCN to carbonyl compounds).

Free radical Addition - Anti Markonikoff's rule (Peroxide effect).

Eliminations-E_1 and E_2 (dehydrohalogenation of alkyl halides).

Oxidation with $KMno_4$, $K_2 Cr_2O_7$; **Reduction** with $LiAlH_4$,$NaBH_4$.

Cyclization (Diels - Alder reaction).

UNIT–IV 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

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exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination , Ozonisation & UV radiation.

UNIT-V Engineering Materials and Drugs:

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.

Conducting polymers- Definition, classification and applications.

Drugs-Introduction,Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

TEXT BOOKS

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Mali, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi,reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition(2011).
4. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C. Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READINGS

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

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18CE C01

ENGINEERING MECHANICS

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

Course Objectives:

1. The objective of this course is to understand the resolution of forces and to obtain resultant of all force systems, to understand moment of a force and equilibrium conditions of static loads for smooth and frictional surface.
2. To obtain centroid, centre of gravity and moment of inertia for various regular and composite areas and bodies.
3. To understand the basic structural analysis, principles of virtual work and energy methods.
4. To know the basic concepts of dynamics and analysis as a particle and rigid bodies.
5. To understand the work energy principles, impulse momentum and their applications and to know the concept of simple harmonic motion and free vibration.

Course Outcomes: The students will be able to

1. Solve problems dealing with forces in plane and space force systems, draw free body diagrams to analyze various problems in equilibrium, for smooth and frictional surface.
2. Determine centroid and moment of inertia for elementary, composite areas and bodies.
3. Analyze simple trusses for forces in various members of a truss.
4. Solve problem in kinematics and kinetics of particles and rigid bodies.
5. Analyze body motion using work energy principles, impulse and momentum approach and able to apply the concepts of simple harmonic motion and free vibrations in dynamics.

Unit–I: Resolution, Resultant and Equilibrium of force system and Friction: Concepts of force, System of forces, components of forces in a plane and in space systems.Resultant of force systems.Moment of forces and its applications.Couples and its applications. Equilibrium of Force systems. Free body diagrams, equation of equilibrium of coplanar and spatial force systems. Static indeterminacy. Types of friction, Laws of friction, application of friction to a single body & connecting systems, wedge friction.

Unit–II: Centroid, centre of gravity and moment of Inertia:
Centroid of simple figures from first principle, centroid of composite sections. Centre of gravity and its implications, Definition of Area moment of Inertia, Moment of inertia of plane section from first principles, Theorems of moment of inertia, moment of inertia of standard sections and composite sections, Mass moment of inertia of rectangular and circular plates, cylinder, cone & sphere.

Unit–III: Analysis of simple trusses, Virtual work and Energy methods:
Analysis of simple trusses using method of joints, methods of sections. Determine if a member is in tension or compression, zero force members. Virtual displacements, Principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom.Conservative forces and potential energy, energy equation for equilibrium.

Unit–IV: Particle Dynamics:
Rectilinear and curvilinear translation using rectangular, normal and tangential components.Relative and constrained motion. Newton's 2nd Law, rectangular and path coordinates. Basic terms, general principles in dynamics, D' Alembert's principle and its application in plane motion and connected bodies.Instantaneous centre of rotation in plane motion and simple problems.

Unit–V: Work- Energy, Impulse-momentum and Mechanical Vibrations:
Equation of work energy for translation and fixed axis rotation, work energy principles applied to particle motion, connected systems. Introduction to linear impulse momentum, principle of conservation of linear momentum, Impact, direct and oblique. Introduction to vibration, free and forced vibrations, simple harmonic motion, simple pendulum and compound pendulum.

Text Books:

1. Reddy Vijaykumar K. and J. Suresh Kumar," Singer's Engineering Mechanics Statics and Dynamics", B. S. Publications 2011.
2. A. Nelson, "Engineering Mechanics", Tata McGraw Hill, New Delhi, 2010.

Suggested Reading:

1. Irving H. Shames, "Engineering Mechanics", 4th Edition, Prentice Hall, 2006.
2. F. P. Beer and E. R .Johnson, "Vector Mechanics for engineers, Vol. I - Statics, Vol. II - Dynamics",
   9thedition, Tata McGraw Hill, 2011.
3. R. C. Hibbeler, "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press, 2006.

18ME C01

ENGINEERING GRAPHICS AND DESIGN

Instruction	1T+4D 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 prepare to design a system, component, or process to meet desired needs within realistic constraints.
2. to prepare the student to communicate effectively.
3. to prepare the student to use the techniques, skills, and modern engineering tools necessary for engineering practice.
4. to get exposure to a CAD package.

Course Outcomes:

1. Introduction to engineering design and its place in society.
2. Exposure to the visual aspects of engineering design.
3. To become familiar with engineering graphics standards.
4. Exposure to solid modelling.
5. Exposure to computer-aided geometric design.
6. Exposure to creating working drawings.
7. Exposure to engineering communication.

Detailed contents

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Coordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling; Introduction to Building Information Modeling (BIM)

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

UNIT-1 Introduction to Engineering Drawing:

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute;

UNIT-2 Orthographic Projections:
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes (without traces); Projections of planes inclined Planes;
Introduction to CAD package:
Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

UNIT-3 Projections of Regular Solids:
Projection of Prism, Cylinder, Pyramid and Cone : Simple position, axis inclined to one of the reference plane only. Customization & CAD Drawing: consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT-4 Sections and Sectional Views of Right Angular Solids:
Sections of solids in simple position Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.
Annotations, layering & other functions:
applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and twodimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

UNIT-5 Isometric Projections:
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Viceversa, Conventions;

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Demonstration of a simple team design project:

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; (Examples of specific components to the branch of study may be included).

Text Books:

1. N.D.Bhatt, Elementary Engineering Drawing, Charotar Publishers,2012.
2. K.L.Narayana and P.K.Kannaiah, -Text Book of Engineering Drawing Scitech Publications, 2011.
3. Basanth Agrawal and C M Agrawal ¯Engineering Drawing 2e ¯, McGraw-Hill Education(India) Pvt.Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., - Engineering drawing 'Pearson, 2ndedition, 2009.
2. K.Veenugopal,-Engineering Drawing and Graphics + AutoCAD' New Age International Pvt.Ltd, 2011.
3. Bhattacharya. B,-Engineering Graphics 'I. K. International Pvt.Ltd, 2009.

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18CS C01

Programming for Problem Solving
(Common to All Programs)

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

Course Objectives

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

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

1. Identify the computing environments.
2. Formulate solutions to problems and represent them using algorithms/ Flowcharts.
3. Choose proper control statements and data structures to implement the algorithms.
4. Trace the programs with test the program solution.
5. Decompose a problem into modules and use functions to implement the modules.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping and nested statements.

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Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes.
Case study:

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

UNIT – IV
Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, function pointers, array of function pointers, dynamic memory allocation, advantages and drawbacks of pointers.

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions and enumerated data types.

UNIT-V
Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.
Preprocessor Directives: Types of preprocessor directives, examples.

Suggested Reading:

1. A K Sharma "**Computer Fundamentals and Programming**", 2nd Edition, University Press, 2018.
2. PradeepDey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017.

References:

1. Byron Gottfried, Schaum's"**Outline of Programming with C**", McGraw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press,2015.
5. https://www.tutorialspoint.com/cprogramming/index.htm
6. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

18CS C02

Programming for Problem Solving
(Programming Lab – I)
(Common to All Programs)

Instruction	4 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives

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

Course Outcomes:

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

1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Identify and rectify the syntax errors and debug program for semantic errors.
4. Analyze the results to evaluate the solutionsof the problems.
5. Solve problems in amodular approach using functions.
6. Implement file operations with simple text data.

Lab experiments

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

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Design the experiments in such a way that the students will be able to end up the solution for a real world problem that uses most of the concepts of C programming language.
For example: A banking application where it uses the concepts of operators, control structures, switch case for menu, structures, functions, error handling, files etc.

Suggested Reading:

1. Pradeep Dey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017
2. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press,2015

References:

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

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18CY C02

CHEMISTRY LAB

(Common to all branches)

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

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. The student should be conversant with the principles of volumetric analysis and identification of organic functional groups.
3. To apply various instrumental methods to analyze the chemical compounds and to improve understanding of theoretical concepts.

Course Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will learn to:

1. Estimate rate constants of reactions from concentration of reactants/ products as a function of time.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
3. Synthesize a small drug molecule and Identify the organic compounds.
4. understand importance of analytical instrumentation for different chemical analysis.
5. Perform interdisciplinary research such that the findings benefit the common man.

Chemistry Lab

1. Estimation of temporary and permanent hardness of water using EDTA solution
2. Estimation of amount of chloride in water.
3. Determination of rate constant for the reaction of hydrolysis of methyl acetate.(first order)
4. Estimation of amount of HCl Conductometerically using NaOH solution.
5. Estimation of (a) amount of CH_3 COOH Conductometerically using NaOH solution. Estimation of (b) amount of HCl and CH_3 COOH present in the given mixture of acids Conductometerically using NaOH solution.

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6. Estimation of amount of HCl Potentiometrically using NaOH solution.
7. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution.
8. Distribution of acetic acid between n-butanol and water.
9. Synthesis of drug - Aspirin.
10. Organic Chemistry- Identification of Functional groups - neutral group (carbonyl groups-acetaldehyde and acetone); acidic group(benzoic acid); basic group (aniline).
11. Determination of surface tension of organic solvents (ethanol, ethyl acetate).
12. Determination of Viscosity.

TEXT BOOKS

1. J. Mendham and Thomas ,"Vogel' s text book of quantitative chemical analysis", Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.

SUGGESTED READINGS

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

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18MT CO3

MATHEMATICS– II

(Common to all Branches and except for Bio-Tech)

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

Course Objectives

1. To evaluate double and triple integrals of various functions and their significance.
2. To evaluate vector line, surface and volume integrals.
3. To know the relevant method to solve higher order differential equations.
4. To evaluate complex integration.
5. To evaluate real and definite integrals.
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. Find the areas, volumes and surface of solids revolution.
2. Use Greens, Gauss and Stoke's theorems to find the surface and volume integrals.
3. Able to solve solutions of differential equations with initial and boundary value problems.
4. Solve the problems on analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Real and complex integrals by using Cauchy's theorems.
6. Solve physical and engineering problems.

UNIT-I: Multivariable Calculus (Integration):
Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals, Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities).

UNIT-II: Vector Integral Calculus:
Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem and Stoke's theorem (without proof).
First Order Ordinary Differential Equations: Exact first order differential equations, Integrating factors, Linear first order equations, Bernoulli's, Riccati's

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and Clairaut's differential equations ,Orthogonal trajectories of a given family of curves.

UNIT-III: Ordinary differential equations of higher orders:
Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point and regular singular point, Power Series solution. Legendre Polynomial of first kind (without proof), Rodrigues formula, Generating function, recurrence relations, orthogonality of Legendre polynomials, Bessel's function of first kind (without proof), recurrence relations and problems.

UNIT-IV:Complex Variables –I :
Differentiation, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof).

UNIT-V: Complex Variables – II:
Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Laurent's series, zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine. Improper real integrals with singular points on the upper half plane.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36^{th} Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9^{th} Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics Narosa Publications, 5^{th} edition, 2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9^{th} Edition, Pearson, Reprint, 2002.

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18PY C01

OPTICS AND SEMICONDUCTOR PHYSICS
(for CSE, ECE & IT)

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

Course Objectives:

The objectives of the course is to make the student

1. Understands the fundamentals of wave nature of light.
2. Acquires knowledge of lasers.
3. Familiar with Quantum Mechanics.
4. Learns the fundamental concepts of solids.
5. Understands the basics of semiconductors.

Course Outcomes:

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

1. Demonstrate the wave nature of the light.
2. Describe the types of lasers and their applications.
3. Explain the importance of wave mechanics.
4. Demonstrate the importance of band theory of solids.
5. Identify the semiconductors for engineering applications.

UNIT-I : Wave optics:

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

UNIT- II : Lasers:

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

UNIT- III : Wave nature of particles and the Schrodinger equation:

Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and timeindependent Schrodinger equation for wavefunction, Born interpretation,

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probability current, Expectation values, Free-particle wavefunction and wave-packets, Uncertainty principle.

UNIT – IV: Introduction to Solids:

Free electron theory of metals, Fermi level, density of states, Application to white dwarfs and neutron stars, Bloch's theorem for particles in a periodic potential, Kronig-Penney model, Scattering from a potential barrier and tunneling; related examples like alpha-decay, field-ionization and scanning tunneling microscope.

UNIT- V :Semiconductors:

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Thermistor, Hall effect, LED, Solar cell.

TEXT BOOKS:

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

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, 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 Limited; 6th Revised edition, 2015.

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18ITC01

OBJECT ORIENTED PROGRAMMING THROUGH C++

Instruction	3L 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 familiarise the syntax and semantics of the C++ programming language.
2. To learn the design of C++ classes for code reuse.
3. To present the concepts of overloading, inheritance and exception handling.
4. To introduce the concept of dynamic binding.
5. To present stream computation and generic classes.

Course Outcomes:

After successful completion of this course, student will be able to

1. Understand the difference between object oriented programming and procedural programming.
2. Identify apt OOPS concepts in designing and implementing a solution.
3. Design and implement solutions for computer problem solving
4. Ascertain exceptions in a problem and handle them.
5. Perform stream computation using files and generic programming using templates.
6. Develop robust programs using OOPS concepts to solve real world problems.

Course 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 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

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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.

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.

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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. 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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18EG C01

ENGLISH

(Common to all branches)

Instruction	2Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	20 Marks
Credits	2

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 equip the students with basics of writing correct sentences to coherent paragraphs.
3. To equip the students with techniques of writing a précis and an essay by using accurate grammar and appropriate vocabulary.
4. To train the students to describe, define and classify processes and to draft formal reports by adhering to the proper structure.
5. To develop the reading skills and reading comprehension techniques of the students.
6. To develop the students reading, writing, grammatical, lexical and communicative competence.

Course Outcomes:

1. The students will understand the nature, process and types of communication and will communicate effectively without barriers.
2. The students will write correct sentences and coherent paragraphs.
3. The students will know how to condense passages by writing précis and write essays by using accurate grammar and appropriate vocabulary.
4. The students will demonstrate advanced writing skills by drafting formal reports.
5. The students will apply their reading techniques and analyze reading comprehension passages.
6. The students will become effective communicators and will display their advanced skills of reading and writing and use correct grammar and appropriate vocabulary in all contexts.

UNIT-I Understanding Communication in English:

Introduction, nature and importance of communication.Process of communication. Basic types of communication - verbal and non-verbal. Barriers to communication. Intrapersonal and interpersonal communication. Johari Window.

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Vocabulary & Grammar: The concept of Word Formation. Importance of proper punctuation. Articles.

UNIT-II Developing Writing Skills I:
Types of sentences. Use of phrases and clauses in sentences. Cohesion and coherence. Paragraph writing. Organizing principles of paragraphs in documents.
Vocabulary & Grammar: Cohesive devices. Root words from foreign languages and their use in English. Prepositions.

UNIT-III Developing Writing Skills II:
Techniques for writing precisely. Précise Writing. Essay Writing.
Vocabulary and Grammar: Subject-verb agreement, Noun-pronoun agreement Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Redundancies, Clichés.

UNIT-IV Developing Writing Skills III:
Describing, Defining, Classifying, Providing examples or evidence. Writing introduction and conclusion.
Report writing – Importance, structure and elements of style of formal reports.
Vocabulary and Grammar: Misplaced modifiers. Synonyms, antonyms

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

Text Books:

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

Suggested Readings:

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

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18PY C02

OPTICS AND SEMICONDUCTOR PHYSICS LABORATORY

(for CSE, ECE & IT)

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

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 semiconductor materials and optoelectronic devices.

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. Understand the applications of semiconductor materials.
4. Know the working of optoelectronic devices.
5. Use LCR circuits in different applications.

Experiments:

1. Error analysis - Estimation of errors in the determination of time period of a torsional pendulum.
2. Hall effect – Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen.
3. Thermistor – Determination of temperature coefficient of resistance of given thermistor.
4. Solar cell - Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance.
5. P-N junction diode – Study of V-I characteristics and calculation of resistance of given diode in forward and reverse bias.
6. Energy gap – Determination of energy gap of given semiconductor.
7. Planck's constant – Determination of Planck's Constant using photo cell
8. I-V characteristics of LED.
9. Photodiode.
10. Laser – Determination of wavelength of given semiconductor red laser.
11. Newton's rings - Determination of wavelength of given monochromatic source.

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12. Diffraction grating – Determination of wavelengths of two yellow lines of mercury light
13. LCR circuit (Resonance)

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
4. Indu Prakash, Ram Krishna and A.K. Jha, A Text Book of Practical Physics, Kitab Mahal Publications, 2012.

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18ITC02

OBJECT ORIENTED PROGRAMMING THROUGH C++LAB

Instruction	4 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	35 Marks
Continuous Internal Evaluation:	15 Marks
Credits	1

Course Objectives:

1. To familiarise the syntax and semantics of the C++ programming language.
2. To facilitate students with the skills required to solve problems using object oriented concepts like Encapsulation, Inheritance, Overloading, etc.
3. To enhance problem solving and programming skills in C++ with extensive exercises.
4. To familiarize exceptional handling for dealing with exceptional test cases.
5. 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++ .
2. Implement object oriented concepts in developing applications using C++.
3. Appropriately use the concepts of Inheritance and polymorphism.
4. Ascertain exceptions in a problem and handle them.
5. Understand stream I/O, Files and usage of the available classes to handle stream objects in C++.
6. Design and develop robust programs using OOPS concepts to solve real world problems.

Prerequisites:

Programming and Problem Solving (16CSC01).

List of Programs

Write C++ Programs to

1. Implement parameter passing techniques in functions.
2. Create Class, Objects and illustrate Static members in a class.
3. Illustrate function overloading, inline functions and friend functions.
4. Implement various types of Constructors and Destructor.
5. Implement method overloading, manipulation of strings, array of Pointers.
6. Overload Unary Operators and Binary Operators.
7. Illustrate types of inheritance and exception handling.

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8. Illustrate virtual functions, pointer to derived class objects, pure virtual functions, Abstract classes and virtual destructors.
9. Implement streams and perform operations on sequential access file and random access file.
10. Illustrate Function Templates and Class Templates.

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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18ME C02

WORKSHOP/ MANUFACTURING PRACTICE

Instruction	1T+4P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits	3

Course Objectives:

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

Course Outcomes – (Laboratory): Student will be able to

1. Fabricate components with their own hands.
2. Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. Assembling different components, student will be able to produce small mechanisms/devices of their interest.
4. Gain practical skills of carpentry, tinsmithy, fitting, house wiring
5. Gain knowledge of different Engineering Materials and Manufacturing Methods.
6. Understand trades and techniques used in Workshop and chooses the best material/ manufacturing process for the application.

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18EG C02

ENGLISH LAB

(Common to all branches)

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:

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. The students will enhance their listening skills by practicing IELTS and TOEFL material.
5. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
6. To help students to understand team work, role behavior and to develop their ability to discuss in groups and make oral presentations.

Course Outcomes:

1. The students will differentiate the speech sounds in English.
2. The students will interact with the software and understand the nuances of pronunciation in English.
3. The students will speak with the proper tone, intonation and rhythm and apply stress correctly.
4. The students will demonstrate their listening skills by analyzing the IELTS and TOEFL listening comprehension texts.
5. The students will speak with clarity and confidence.
6. The students will work in teams and discuss various topics and demonstrate their presentation skills through posters.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs. The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.

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4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** -practice with IELTS and TOEFL material.
6. **Situational dialogues and role play-** Dialogue writing, **–** Role behavior and role enactment.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Public speaking -** Speaking with confidence and clarity in different contexts on various issues.
9. **Poster presentation -** Theme, poster preparation, team work and presentation.

Suggested Reading

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

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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.

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”, Pearson, 2014.

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

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.

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 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 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, 2nd edition, 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", 3rd edition, 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++”, 2nd Edition, John Wiley, 2011.

Suggested Reading:

1. Narasimha Karumanchi, “Coding Interview Questions”, 3rd Edition, CareerMonk Publications, 2016.
2. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, 3rd 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.

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.

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.

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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”, 4^{th} 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”, 4^{th} edition, Pearson Education, 2000.
2. Andrew S. Tanenbaum, “Computer Networks”, 5th edition, Pearson Education.
3. Gilbert Held, “Understanding Data Communications”, 7^{th} Edition, Pearson Education.

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 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", 8^{th} Edition, Tata McGraw Hill Publications, 2011.
2. Cay S. Horstmann, Gary Cornell: "Core Java, Volume I—Fundamentals", 8^{th} edition, Prentice Hall, 2008.

Suggested Reading:

1. Sachin Malhotra&SaurabhChoudhary: "Programming in Java", 2^{nd} Edition, Oxford University Press, 2014.
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., 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

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), Cross

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.

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.

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

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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™: The Complete Reference Java", 8th edition, Tata McGraw Hill Publications, 2011.
2. Sachin Malhotra&SaurabhChoudhary: "Programming in Java", 2nd 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.

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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16ITC16

PRINCIPLES OF OPERATING SYSTEMS

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

Course Objectives:

This course is introduced to

1. Learn various services provided by an operating system.
2. Learn, what a process is and how processes are synchronized and scheduled.
3. Learn different approaches of memory management.
4. Familiarizewith the structure and organization of the file system.
5. Familiarize with Protection and security aspects of operating systems.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Understand the services of an operating system, inter process communication and multithreaded programming.
2. Identify suitable process scheduling, deadlocks handling algorithms and solve process-synchronization problems.
3. Understand the organization of Main and Virtual memory in the operating system.
4. Understand File-System management.
5. Understand the Security problems, Threats and Protection mechanisms.
6. Choose an efficient algorithm based on different aspects for better performance of the system.

Prerequisites:

Computer Organization and Microprocessor (16ITC11), Programming and Problem Solving (16CSC01), Data Structures & Algorithms (16ITC02).

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 Kernel Data Structures Computing Environments , Open-Source Operating Systems .

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Operating System Structures: Operating-System Services, User and Operating-System InterfaceSystem 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 of Synchronization, 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.

UNIT–III

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.

UNIT–IV

Mass-Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management
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.

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.

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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 publications, 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, "An Intoduction to Opearting Systems concepts and practice", Third Edition, PHI, 2014.

Web Resources:

1. http://nptel.ac.in/downloads/106108101/
2. http://www2.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/
3. http://www.cs.kent.edu/~farrell/osf03/oldnotes/

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16ITC17

DATABASE SYSTEMS

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

Course Objectives:

This course is introduced to

1. Familiarize with the fundamental concepts and the role of a database system in an organization.
2. Acquire knowledge on different issues in the design and implementation of a database system.
3. Learn how to write simple and moderately advanced database queries using SQL.
4. Learn logical database design and various database models.
5. Study the concepts of database security, concurrency and recoverability.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Understand the purpose of database systems and Design any domain specific database using E-R model by considering all the constraints and issues in the related domain.
2. Design and implement a database for any specified domain according to the well-known Relational data model and formulate Relational algebra expressions.
3. Use SQL for efficient data retrieval queries, advanced SQL concepts to access databases from programming languages and define various triggers to ensure the consistency of the databases.
4. Understand and apply normalization concepts in the design of a relational database.
5. Efficiently organize and manage data using indexing and hashing concepts to achieve good data retrieval performance.
6. Understand the concept of a database transaction and related database facilities, including concurrency control, backup and recovery, and data object locking and protocols.

Prerequisites:

Data Structuresand Algorithms (16ITC02), Java programming (16ITC10)

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UNIT-I

Introduction: Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval Specialty Databases, Database 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.

UNIT–II

Introduction to the Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations.

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database.

Intermediate SQL: Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization.

UNIT–III

Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, Advanced Aggregation Features.

Relational Database Design: Features of Good Relational, Designs, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition using Multivalued Dependencies.

UNIT-IV

Indexing and Hashing: Basic Concepts, Ordered Indices, B+ Tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Index Definition in SQL

Transactions: Transaction Concept, a Simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels.

UNIT–V

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion

Schemes, Snapshot Isolation, Insert Operations, Delete Operations and Predicate Reads.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, ARIES, Remote Backup Systems.

Text Book:

1. Abraham Silberschatz, Henry F Korth, S. Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill International Edition, 2010.

Suggested Reading:

1. C J Date, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2003.
2. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database System", Sixth Edition, Addison-Wesley, 2011.
3. Raghu Ramakrishnan,JohannesGehrke, "Database Management Systems", Third Edition, McGraw-Hill International Edition, 2014.
4. Patric O'Neil, Elizabeth O'Neil, "Database-principles, programming and performance", Second edition, Morgan Kaufmann Publishers, 2001.

Web Resources:

1. http://db-book.com/
2. https://www.tutorialspoint.com/dbms/
3. https://www.w3schools.in/dbms/
4. http://www.oracle-dba-online.com/sql/oracle_sql_tutorial.htm.
5. http://www.tutorialspoint.com/plsql/

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16ITC18

SOFTWARE ENGINEERING

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

Course Objectives:

This course is introduced to

1. Describe the various software life cycle models.
2. Explain the importance of the software development process.
3. Acquaint the students with software requirements and SRS document.
4. Familiarize the students with different software architectural styles.
5. Explain the importance of software quality and review techniques.

Course Outcomes:

Upon successful completion of this course, the students should be able to

1. Understand the nature of software and definition of software engineering, agile software development and agile process models.
2. Recognize the minimum requirements for the development of application.
3. Develop a system, component, or process to meet desired needs of a customer, conduct tests using various testing methods to verify and validate the results.
4. Involve in developing, maintain, efficient, reliable and cost effective software solutions.
5. Understand the risks, formulate and implement software projects.
6. Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Prerequisites:

Programming and Problem Solving (16CSC01), Design and analysis of algorithms (16ITC08).

UNIT-I

Software and Software Engineering: The Nature of Software, Software Engineering. The Software Process, Software Engineering Practice.

A Generic view of Process : Software Engineering -A Layered Technology, A Process frame work, Process Models-Waterfall model, spiral model, The Unified Process, Product and Process, Process Assessment and Improvement, The CMMI, Agility: Introduction to Agile development, Product development in Internet time, Agile Process models-Scrum, Extreme programming, Agile Vs Waterfall Model.

Understanding Requirements: Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements.

Requirements Modelling: Requirements Analysis, Scenario-Based Modeling, Problem Analysis, Data Flow Diagrams, Software Requirement and specifications, Behavioural and non-behavioural requirements.

UNIT-II

Design Concepts: Design within the Context of Software Engineering, The Design Process, Design Concepts. Cohesion & Coupling, Object Oriented Design-Identifying Objects and classes, User Interface Design.

Architectural Design: Software Architecture, Architecture Styles-pipe and filter architecture, black board architecture , layered architecture.

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.

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, 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, system testing, validation testing, beta testing, alpha testing, acceptance testing, regression testing,

Product Metrics: A Framework for Product Metrics, Size Metrics like LOC, Function points.

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UNIT-V

Estimation: Observations on Estimation, the Project Planning Process, Software Scope and Feasibility, Resources, Software Project Estimation.

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", 7th edition, McGrawHill, 2009.
2. Jim Highsmith, "Agile Software Development Ecosystems", Addison-Wesley 2002, ISBN 0201760436, 2010.

Suggested Reading:

1. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, "Fundamentals of Software Engineering", PHI, 2nd edition,2010.
2. Ali Behforoz and Frederic J.Hadson, "Software Engineering Fundamentals", Oxford End Press, 2010.
3. Pankaj Jalote, "An Integrated Approach to Software Engineering", 3rdedition, Narosa Publishing house, 2008.
4. James F.Peters, WitoldPedrycz, "Software Engineering-An engineering Approach", McGraw Hill, 2008.

Web Resources:

1. Software Engineering Sites: http://www.erg.abdn.ac.uk/users/brant/sre/soft-eng.html.
2. SE web - Software Engineering Education Home Page: http://tuvalu.cs.flinders.edu.au/seweb/se-ed/
3. ACM Classic Books Series: http://www.acm.org/classics/
4. Teaching Software Engineering - Lessons from MIT, by Hal Abelson and Philip Greenspun: http://philip.greenspun.com/teaching/teaching-software-engineering.
5. NASA Software Engineering Home Page:http://akao.larc.nasa.gov/dfc/swreng.html
6. Software Engineering Hotlist at Georgia Tech: http://www.cc.gatech.edu/computing/SW_Eng/hotlist.html
7. IEEE Guide to the Software Engineering Body of Knowledge: http://www.swebok.org/

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16ITC19

WEB TECHNOLOGY

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

Course Objectives:

This course is introduced to

1. Acquire knowledge about design and development of web pages.
2. Develop dynamic pages using Java Servlets and JSP.
3. Know about database connectivity and how it can be used in Web-based applications.
4. Describe the state of the art of frameworks.
5. ASP.NET, to tackle challenges that are simply out of reach on many other platforms.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Design responsive websites and validate web forms using JQuery.
2. Write a well-formed XML schemas and documents.
3. Develop dynamic web applications using Servlets and JSP.
4. Apply modern Framework techniques for web development to make applications maintainable.
5. Validate various types of controls.
6. Design and develop web applications using ASP.NET with Ajax based requests.

Prerequisites:

Java Programming (16ITC10)

UNIT-I

Introduction: Web Fundamentals, **HTML 5.0:** basic tags, Form controls, Layout Management, Graphics, Media, span and div tags.

Introduction to Cascading Style Sheets: CSS Selectors, CSS BOX Model, CSS Positioning, and CSS floating.

JQuery: Basics of JavaScript, JQuery syntax, Selectors, Events, JSON Fundamentals.

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UNIT-II

Introduction to XML: The Syntax of XML, XML Document Structure, Document Type Definitions, Name Space, XML Schemas, Displaying XML Documents with CSS, XSLT Style Sheets and XML Processors.

Web Services: Web Service Architecture, structure and contents of SOAP message, structure of WSDL, Information in UDDI registry, UDDI Registry API.

UNIT-III

Java Servlets: Overview of Java Servlet API, Servlet Implementation, Servlet Configuration, Servlet Exceptions, Servlet Life cycle, Request and Response methods, Approaches to Session tracking, Request dispatching.

JSP Basics: Introduction to JSP, Directives, Scripting Elements, Standard Actions.

Database Connections: Introduction to JDBC, Database Drivers, JDBC API, connecting to my SQL, connecting to oracle, working with No SQL databases.

UNIT-IV

Struts framework: MVC Design pattern, Introduction to the modern web application framework, Architecture and flow of execution, working with actions and interceptors, Building the view with Tags and Results in detail, OGNL and type conversion, exploring the validation framework, writing the custom validator and Struts application development.

UNIT-V

ASP.NET: .Net framework, Web Form fundamentals-Html server controls, HTML control classes, Application events,ASP.net Configuration, Basic Web Control classes, State management, Building better web form - Validation, rich controls, user controls and graphics, ADO.NET Fundamentals, ASP.NET with Ajax.

Text Books:

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. Gustavo Alonso ,"Web Services: Concepts, Architectures and Applications" Springer Science & Business Media, 2004
4. Phil Hanna, "The Complete Reference JSP", First Edition, Tata McGraw-Hill, 2003
5. Donald Brown, Chad Michael Davis, Scott Stanlick, "Struts 2 in Action",Manning Publications, 2008.
6. Matthew MacDonald, "Beginning ASP.NET 4.5 in C#", Illustrated, Apress, 2012.

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Suggested Reading:

1. James Webber, SavasParastatidis, Ivan Robinson,” Restin Practice: HyperMedid and System Architecture”, First Edition,O’REILLY,2010.
2. Deitel, Deitel, Goldberg, “Internet & World Wide Web How To Program”, Third Edition, Pearson Education, 2010.
3. SubramanyamAllamraju, “Professional Java Server programming”, J2EE 1.3 Edition, CeditBuest, Apress Publications

Web Resources:

1. https://msdn.microsoft.com/en-us/library/office/aa218647(v=office.11).aspx
2. https://sipb.mit.edu/iap/django/CCCDjango2010.pdf

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16ITC20

THEORY OF AUTOMATA

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

Course Objectives:

This course is introduced to

1. Study abstract computing models namely Finite Automata, Pushdown Automata, and Turning Machines.
2. Learn various grammars, formal languages and their relationships.
3. Learn the relation between various grammars and recognizers for different formal languages.
4. Evaluate and explain the differences between different computational models, such as Turing machines, push-down automata, finite automata, etc.
5. Familiarize with decidability and undecidability of computational problems.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Understand formal machines, languages and design Deterministic, Nondeterministic Finite automata for acceptance of languages.
2. Build regular expressions and their equivalent finite automata for different languages.
3. Define context-free grammars for certain languages and check the ambiguity of the grammars.
4. Design pushdown automata for accepting languages.
5. DesignTuring machines for computational problems, distinguish between decidability and undecidability.

Prerequisites:

Discrete Structures and Applications (16ITC01) and Data Structures and Algorithms (16ITC02).

UNIT-IAutomata: Introduction to Finite Automata, the Central Concepts of Automata Theory: Alphabets, Strings, and Languages.

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Finite Automata: An Informal Picture Of Finite Automata: The Ground Rules, the Protocol, Enabling the Automata to Ignore Actions, the Entire System as an Automaton. Deterministic Finite Automata: Definition of a DFA, Simpler Notations for DFA's, Extending the Transition Function to Strings, The Language of a DFA, Nondeterministic Finite Automata: Definition of NFA, The Extended Transition Function, The Language of an NFA, Equivalence of NFA and DFA, An Application: Text Search, Finite Automata with Epsilon-Transitions: Use of €-transitions, The formal notation for an €- NFA, €-closure, Extended Transitions and Languages for €-NFA's, Eliminating €-transitions.

UNIT-II

Regular Expression and languages: Regular Expressions: The Operators of Regular Expressions, Building Regular Expressions. Finite Automata and Regular Expression: From DFAs to Regular Expressions, Converting DFA's to Regular Expressions by Eliminating States, Converting Regular Expressions to Automata, Applications of Regular Expressions, Algebraic Laws for Regular Expressions.

Properties of Regular Languages: Proving Languages not to be Regular: The pumping lemma for Regular Languages, Applications of Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages: Testing Emptiness of Regular Languages, Testing Membership in a Regular Language. Equivalence and Minimization of Automata: Testing Equivalence of States, Testing Equivalence of Regular Languages, Minimization of DFA's.

UNIT-III

Context Free Grammars and Languages: Context-Free Grammars: Definition of Context Free Grammars, Derivations using a Grammar, Leftmost and Rightmost Derivation, The language of a Grammar, Parse Trees: Constructing Parse Trees, The Yield of a Parse Tree, Applications of CFGs, Ambiguity in Grammars and Languages: Ambiguous Grammars, Removing Ambiguity From Grammars, Leftmost Derivations as way to Express Ambiguity, Inherent Ambiguity.

Properties of Context Free Languages: Normal Forms for Context-Free Grammars: Eliminating Useless Symbols, Computing the Generating and Reachable Symbols, Eliminating Productions, Eliminating Unit Productions, Chomsky Normal Form, Greibachnormal form, Pumping Lemma for CFL's: Statement of the Pumping Lemma, Applications of Pumping Lemma for CFL's, Closure Properties of CFL's, Decision Properties of CFL's: Testing Emptiness of CFL's, Testing Membership in a CFL's.

UNIT-IV

Pushdown Automata: Definition of pushdown automaton: The Formal Definition of PDA, Graphical Notation for PDA's, Instantaneous Description of a PDA, The Language of a PDA: Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final State, From Final State to Empty Stack, Equivalence of PDA's

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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.

UNIT-V

Introduction to Turing Machines: Problems that Computer Cannot Solve: The Turing Machine: Notation for the TM, Instantaneous Descriptions for TM's, Transitions Diagrams, The Language of a TM, Turing Machines and Halting, Programming Techniques for Turing Machines: Storage in the State, Multiple Tracks, Subroutines, Extensions to the Basic Turing Machine: Multitape Turing Machine, Equivalence of One-Tape and Multi-Tape TM's, Nondeterministic Turing Machines, Restricted Turing Machines: TM's with Sem infinite Tapes, Multistack Machines, Counter Machines. Turing Machine and Computers: Simulating a Computer by a TM.

Undecidability: A Language That Is Not Recursively Enumerable: Enumerating the Binary Strings, Codes for Turing Machines, The Diagonalization Language, An Undecidable problem that is RE: Recursive Languages, Compliments of Recursive and RE languages, The Universal Languages, Undecidablity of the Universal Language, Undecidable problems about Turing Machines: Reductions, TM's That Accept The Empty Language, Rice's Theorem and Properties of RE languages, Post's Correspondence Problem: Definition of PCP, The Modified PCP, Other Undecidable Problems.

Text Book:

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

Suggested Reading:

1. John C Martin. "Introduction to Language and Theory of Computation", 3^{rd}edition, TMH, 2003.
2. Daniel Cohen, "Introduction to Computer Theory", 2^{nd}edition, Wiley Publications, 2007.
3. Mishra K., Chandrasekaran N., "Theory of Computer Science (Automata, Languages and Computation)", 3^{rd} edition, Prentice Hall of India 2008.
4. ShyamalendraKandar, "Introduction to Automata Theory, Formal Languages and Computation", Pearson, 2013.
5. Kamala Krithivasan, Rama R. "Introduction to Automata Theory, and Computation", Pearson 2009.

Web Resources:

1. http://nptel.ac.in/courses/106106049/
2. http://online.stanford.edu/course/automata-theory
3. https://www.tutorialspoint.com/automata_theory/

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16ITE01

PYTHON PROGRAMMING

(Elective - I)

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

Course Objectives:

This course is introduced to

1. Familiarize the fundamentals of Python programming
2. Learn how to use lists, tuples, and dictionaries in Python programs
3. Learn how to read and write files in Python
4. Impart usage of exception handling in Python
5. Familiarize data visualization

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Understand basic data structures of python
2. Understand the concepts of file I/O
3. Understand exception handling in Python.
4. Develop proficiency in creating GUI based applications
5. Plot data using appropriate Python visualization libraries
6. Develop simple Python applications.

Prerequisites:

Programming and Problem Solving (16CSC01), Programming Laboratory (16CSC02)

UNIT-I

Introduction to Python Programming: Using Python, The IDLE Programming Environment, Input and Output Processing, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, More About Data Output: New line, Item Separator, Escape Characters, Formatting parameters.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.

Repetition Structures: Introduction, while loop, for loop, Sentinels, Input Validation Loops, Nested Loops.

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UNIT-II

Functions: Introduction, Defining and Calling a Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions Generating Random Numbers, Writing Our Own Value-Returning Functions, The math Module, Random Module, Time Module and Storing Functions in Modules.

UNIT-III

Lists and Tuples: Sequences, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples.

Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings.

Dictionaries and Sets: Dictionaries, Sets, Serializing Objects.

Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms.

UNIT-IV

Python File Input-Output: Opening and closing file, various types of file modes, reading and writing to files, manipulating directories

Exception Handling: What is exception, various keywords to handle exception such try, catch, except, else, finally, raise.

Regular Expressions: Concept of regular expression, various types of regular expressions, using match function.

UNIT-V

GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

Introduction to plotting in Python – Basic Plots- Line and Scatter Plot, Histograms and plotting data contained in files.

Text Books:

1. Tony Gaddis, "Starting Out With Python", 3rd edition, Pearson, 2015.
2. Charles Dierbach, "Introduction to Computer Science using Python", Wiley, 2013.

Suggested Reading:

1. Kenneth A. Lambert, "Fundamentals of Python", Delmar Cengage Learning, 2013.
2. James Payne, "Beginning Python using Python 2.6 and Python 3", wrox programmer to programmer, 2010.

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3. Paul Gries, "Practical Programming: An Introduction to Computer Science using Python",3rd edition, 2016.
4. Clinton W. Brownley, "Foundations for Analytics with Python", 1st edition, O'Rielly Media, 2016.

Web Resources:

1. https://www.python.org/
2. https://www.coursera.org/learn/python
3. https://learnpythonthehardway.org/book/
4. https://www.coursera.org/specializations/python

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16ITE02

UNIX AND SHELL PROGRAMMING

(Elective - I)

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

Course Objectives:

This course is introduced to

1. Familiarize students with the UNIX environment and basic UNIX utilities
2. Learn File systems and File structures.
3. Impart skills required to write shell scripts.
4. Develop skills required to formulate regular expressions.
5. Familiarize students with the routine system administrative features and tools.

Course Outcomes:

Upon successful completion of this course, the students should be able to

1. Understand the UNIX architecture, basics of vi editor and UNIX utilities.
2. Implement various File processing commands, change file permissions and directory permissions.
3. Create and manage processes using the knowledge of process attributes process creation and process control mechanisms.
4. Construct simple and complex shell scripts to automate jobs and processes in UNIX environment.
5. Locate and replace patterns at specific locations using regular expressions
6. Demonstrate administrator privileges, super user basic commands to add, modify and delete users.

Prerequisites: Programming and Problem Solving (16CSC01), Programming Laboratory (16CSC02).

UNIT-I

Introduction to Unix: The UNIX Operating System, The UNIX Architecture, Features of UNIX, Internal and External Commands, Command Structure,
General-Purpose Utilities:cal, date, echo, printf, bc, script, mailx, passwd, who, uname, tty, sty,
The vi editor: vi Basics, Input Mode, Saving Text and Quitting, Navigation, Editing Text, Undoing Last Editing Instructions, Repeating the Last Command, Searching for a Pattern, Substitution.

UNIT-II

Handling Files: The File System, Parent Child Relationship, The HOME variable, pwd,cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames, The UNIX File System cat, cp, rm, mv, more, file, ls, wc, cmp, comm, diff,

Compressing and Archiving files: gzip and gunzip- Compressing and Decompressing files, tar- The Archival program, zip and unzip- Compressing and Archiving together.

File Attributes: ls options -l, -d,-lh,-la, File Ownership, File Permissions, chmod-Changing File permissions, Directory Permissions, Changing File ownership.

UNIT-III

The Shell: The Shells's interpretive Cycle, Shell Offerings, Pattern Matching, Escaping and quoting, Redirection, /dev/null and /dev/tty, Pipes, tee- Creating a tee, Command Substitution, Shell Variables.

The Process: Process Basics, ps- Process Status, System Processes (-e or –a), Mechanism of Process creation, Internal and External Commands, Process states and Zombies, Running jobs in Background, nice-Job Execution with low priority, Killing Processes with signals, Job Control, at and batch-Execute later, cron- Running jobs periodically, time-Timing Processes.

UNIT-IV

Simple Filters: pr-Paginating Files, head- Displaying the beginning of a File, tail-Displaying the end of a File, cut- Slitting a File vertically, paste-Pasting Files, sort-Ordering a File, uniq- Locate Repeated and Non-repeated Lines, tr- Translating Characters.

Filters using Regular Expressions: grep, Basic Regular Expressions, Extended Regular expressions, egrep, sed, Line Addressing, Using multiple instructions, Context Addressing, Writing Selected lines to a File, Text Editing, Substitution.

UNIT-V

Shell Programming: Shell scripts, read, Using Command Line Arguments, exit, The logical operators && and ||, Conditional execution- if, Using test and [ ] to evaluate expressions, case, expr, while, for, set and shift, trap, Debugging shell scripts with set–x.

System Administration: root, The administrator's privileges, Maintaining Security, User Management, Startup and Shutdown, Managing Disk Space, Device Files.

Text Book:

1. Sumitabha Das, "Unix Concepts and Applications", 4th Edition, TMH, 2006.

Suggested Reading:

1. Behrouz A. Forouzan, Richard F. Gilbery, "Unix and Shell Programming", 1st Edition, Cengage Learning India, 2003.

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2. Graham Glass, King Ables, "Unix for programmers and users", 3rd Edition, Pearson Education, 2009.
3. YashwanthKanitkar, "Unix Shell programming", 1st Edition, BPB Publishers, 2010.

Web Resources:

1. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=PracticalUnix
2. https://www.shellscript.sh/
3. www.bash.academy/
4. http://linuxcommand.org/

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16ITE03

SCRIPTING LANGUAGES

(Elective - I)

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

Course Objectives:

This course is introduced to

1. Write scripts to extract meaningful summaries from partially structured text.
2. Prepare students to use Python to perform common scripting tasks.
3. Allow students to use scikit-image library to learn image processing algorithms.
4. Familiarize students with PHP for making dynamic and interactive web pages.
5. Improve VB Scripting Skills for writing desktop, web applications and automation of tasks.

Course Outcomes:

Upon successful completion of this course, the students should be able to

1. Use Perl language features in web application development
2. Master the fundamentals of writing Python scripts
3. Implement algorithms and techniques involved in Digital Image Processing using scikit-image package
4. Gain the PHP programming skills needed to successfully build interactive, data-driven websites.
5. Use Ajax technology to load new content without leaving the current page, creating a better, faster experience for webpages
6. Develop web, desktop and various automation tasks using Visual Basic Scripting (VB Script)

Prerequisites:

Programming and Problem Solving (16ITC01), Data structures and algorithms (16ITC02)

UNIT-I

PERL- Names and Values, Variables, Scalars, Arrays and its operations, Hashes, Regular expressions, string manipulation, File management, Command line arguments, sub routines, Packages, Modules.

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UNIT-II

Introduction to Python: Variables, Lists and Tuples, Introducing Functions , If statements, While Loops and Input, Basic Terminal Apps, Dictionaries, More Functions, Classes and OOPs, Exceptions.

UNIT-III

Simple Graphics and Image Processing using Python: "turtle" module; simple 2d drawing - colors, shapes; digital images, image file formats, image processing Simple image manipulations with 'image' module (convert to between, grey scale, blur, etc). Graphical user interfaces; event-driven programming paradigm; tkinter module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames.

UNIT-IV

Programming with PHP: PHP Basics, String Manipulation and regular expressions, Form handling, Adding dynamic Content, Managing Web sessions, Handling Date & Time in PHP, Sending email with PHP, Object Oriented Programming and PHP7, Exception handling, Accessing Databases using PHP, AJAX with PHP.

UNIT-V

VBScript: Introduction to VBScript, Declaring and Using Variables, Operators, Operator Precedence and Constants, Using Conditional Statements, Loops in VBScript, Using Procedures and Functions, Arrays, Date Functions, Working with Strings and Cookies, Working with Events, Working with Excel Objects, Working with Connection Objects, Working with Files, Error Handling

Text Books:

1. Randal L. Schwartz, Tom Phoenix, brianfoy, "Learning Perl", 5th Edition, O'Reilly Media, 2008.
2. Kenneth A. Lambert , "Fundamentals of Python First Programs", Cengage Learning, 2012.
3. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", Pearson Education, 2017.
4. Kogent Solutions Inc, "Ajax Black Book", Dreamtech press, 2008.
5. Adrian Kingsley-Hughes, Kathie Kingsley-Hughes, Daniel Read, "VBScript – Programmers Reference", 3rd Edition, wiley publications, 2007.

Suggested Reading:

1. John ericsolem, "Programming Computer Vision with Python", First edition, O'Reilly Media, 2012
2. Thomas A Powel, "The Complete Reference: AJAX", 1st Edition, Tata McGraw Hill, 2008.

Web Resources:

1. https://docs.python.org/3/tutorial/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/
3. https://learn.perl.org/

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16ITC21

OPERATING SYSTEMS AND WEB TECHNOLOGY LAB

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

This course is introduced to

1. Familiarize with various system calls of LINUX
2. Learn processes synchronization and scheduling algorithms
3. Design and develop web pages using html5, CSS positioning, servlets and JDBC.
4. Learn and write a well-formed XML schemas and documents.
5. Learn MVC based web application development using Struts2 and ASP.NET.

Course Outcomes:

Upon successful completion of this course, the students should be able to

1. Create multiple processes and replace a process image using different system calls.
2. Understand Inter-process communication using shared memory, message passing and pipes.
3. Analyze and evaluate different algorithms for CPU scheduling.
4. Design various web based applications using HTML5,Jquery and CSS.
5. Use JDBC, JSP and Struts 2 framework, to build modem web applications.
6. Design web site using ASP.NET with Ajax based requests.

Prerequisites:

Programming Laboratory (16CSC02), Data Structures and Algorithms Lab (16ITC05), Java Programming Lab (16ITC13).

List of Programs

1. Demonstrate the following system calls:
   a) fork b) execvp c) stat d) setenv&getenv
2. Implement Echo Server using
   a) Pipes b) Shared memory c)Message queues

3. Simulate the following CPU Scheduling Algorithm:
   a) FCFS b) SJF c) Round Robin
4. Implement Producer-Consumer Problem using
   a) Message passing b) Semaphores
5. Develop an e-commerce web site having the following specifications
   a) Use css for styling all the web controls.
   b) Use jquery for all form validations.
   c) All form submissions should be with AJAX only.
   d) Use menus in appropriate places.
6. Write a DTD and Schema for a library management system and give an XML example for each.
7. Build a java based dynamic working e-commerce website mentioned in question no.5 with database connections.
8. Develop a struts2 framework based "registration and login" application making use of validator framework.
9. Design and develop a simple web based application for "online quiz management" using ASP.NET.
10. Write an application to demonstrate data management using ADO.NET.

Text Books:

1. W. Richard Stevens, "Unix Network Programming", Volume 2, 2nd edition, Pearson Education, 2015.
2. Robert W.Sebesta, "Programming with World Wide Web", Eighth Edition, Pearson Education, 2008.
3. John Pollak, "JQuery - A Beginners Guide", McGraw-Hill Education, 2014.
4. Phil Hanna, "The Complete Reference JSP", First Edition, Tata McGraw-Hill, 2003.
5. Matthew MacDonald, "Beginning ASP.NET 4.5 in C#", Illustrated, Apress, 2012.

Suggested Reading:

1. Silberschatz, Galvin, and Gagne,"Operating System Concepts", 8thEdition,Wiley Publication.
2. Andrew S. Tanenbaum, "Modern Operating Systems", 3rd Edition, GOAL Series.
3. James Webber, SavasParastatidis, Ivan Robinson,"Rest in Practice: HyperMedid and System Architecture", First Edition,O'REILLY,2010.

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4. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2010.
5. SubramanyamAllamraju, "Professional Java Server programming", J2EE 1.3 Edition, CeditBuest, Apress Publications.

Web Resources:

1. http://www.tutorialspoint.com/unix/
2. https://msdn.microsoft.com/en-us/library/office/aa218647(v=office.11).aspx

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16ITC22

DATABASE SYSTEMS LAB

Instruction	3L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course objectives:

This course is introduced to

1. Present the concepts and techniques relating to query processing.
2. Design and develop database for an application.
3. Learn the basic commands, SQL functions and the significance of triggers.
4. Learn how to manipulate a database using SQL.
5. Familiarize with the various methods of database security.

Course outcomes:

Upon successful completion of this course, the students should be able to:

1. Design and implement database schemas by enforcing integrity constraints for a given problem domain.
2. Use SQL for database administration(to create tables, indexes, and views) and data manipulation.
3. Write efficient data retrieval queriesusing relational set operators and advanced SQL Join operators.
4. Do PL/SQL programming and define various triggers and cursors for the databases.
5. Create Security features and facilities for the database applications.
6. Design, create, and test data entry forms and detailed reports that require access to data in multiple tables.

Prerequisites:

Programming and Problem Solving (16CSC01)

List of Programs

1. Creation of database (Exercising commands like DDL and DML) (Note: use constraints while creating tables).
2. Exercising simple to complex queries.

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a. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSECT Constraints.
b. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING clause and Creation and dropping of Views.
c. Exercising all types of Joins.

3. Demonstration of PL/SQL Blocks and Cursors.
4. Demonstration of Procedures and Functions.
5. Usage of Triggers (Programs using BEFORE and AFTER Triggers, Row and Statement level Triggers and INSTEAD OF Triggers).
5. Demonstrate Exception Handling by PL/SQL procedures for data validation.
6. Creating Password and Security features for applications.
7. Usage of File locking table locking, facilities in applications.
8. Creation of Forms and Generation of SQL reports.
9. Creation of full-fledged 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.

Text Book:

1. Rick F Vander Lans, "Introduction to SQL", Fourth edition, Pearson Education, 2007.

Suggested Reading:

1. Benjamin Rosenzweig, Elena Silvestrova, "Oracle PL/SQL by Example", Fifth Edition, Pearson Education, 2015.
2. Albert Lulushi, "Oracle Forms Developer's Handbook", Pearson Education, 2006.

Web Resources:

1. http://www.oracle-dba-online.com/sql/oracle_sql_tutorial.htm.
2. https://www.javatpoint.com/sql-tutorial
3. https://www.tutorialspoint.com/sql/
4. http://www.tutorialspoint.com/plsql/
5. https://www.javatpoint.com/pl-sql-tutorial

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16ITC23

MINI PROJECT - III

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

Course Objectives:

1. To enable students learn by doing.
2. To develop capability to analyse and solve real world problems.
3. To develop innovative ideas among the students.

Course Outcomes:

Students should be able to do the following:

1. To provide innovative solutions.
2. To work in a team.
3. To manage time and resources in the best possible manner.

The Students are required to implement one of the projects from project exercise given in the suggested readings of the theory subjects of the current semester / as suggested by the respective course faculty of that semester. 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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16ITC24

COMPUTER NETWORKS AND SOCKET PROGRAMMING

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

Course Objectives:

This course is introduced to

1. Familiarize students with basics of Socket based Client/Server programming.
2. Provide state-of-the-art knowledge on Network Layer issues including Routing, Addressing, Congestion Control and Quality of Service.
3. Give an overview of how Networks differ and how they can be interconnected.
4. Introduce IP based transport protocols TCP and UDP.
5. Give an insight into the working principles of popular Internet Applications including Email and Domain Name System.
6. Provide a solid understanding of main issues related to network security and the relevant cryptographic techniques.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Enumerate functions of each layer in the OSI and TCP/IP reference models and build Client/Server applications using the understanding of Socket System calls.
2. Solve problems related to Addressing, Routing and Congestion in computer networks.
3. Understand Internetwork Routing issues and Interoperability among heterogeneous networks.
4. Analyze the functions and performance of Internet Transport Protocols TCP and UDP.
5. Understand the operating principles of Domain Name System and Electronic Mail.
6. Comprehend various network security threats and cryptographic algorithms.

Prerequisites:

Data Communications (16ITC09), Programming and Problem Solving (16CSC01).

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UNIT-I

Introduction: Uses of Computer Networks, ISO/OSI and TCP/IP Reference Models, Comparison of the OSI and TCP/IP Reference Models.

Socket programming: Socket address, Elementary socket system calls, Advanced socket system calls, Reserved ports, Socket options, Asynchronous I/O, Out-of-Band data, Internet Super Server, Daemon Processes.

UNIT-II

Network Layer Design Issues: Store and Forward Packet switching, Services, Implementation of Connectionless Service and Connection-Oriented Service, Comparison of Virtual circuits and Datagram subnets.

Routing Algorithms: The Optimality principle, Shortest path routing, Flooding, Distance vector Routing, Link state Routing, Hierarchical Routing, Broadcast and Multicast routings,

Congestion control algorithms: Approaches, Traffic-Aware Routing, Admission Control, Traffic Throttling, Load Shedding,

Quality of Service: Application Requirements, Traffic shaping Packet Scheduling, Integrated and Differentiated Services.

UNIT-III

Internetworking: How networks differ, How networks can be Connected, Tunneling, Internetwork routing, Packet Fragmentation,

The Network Layer in the Internet: The IPv4 protocol, IP addresses, Subnets, Classless Inter Domain Routing, Classful and Special Addressing, Network Address Translation, IP version 6, Label Switching and MPLS, OSPF, BGP.

UNIT-IV

Transport Layer: Transport service primitives, Addressing, Connection Establishment, Connection Release, Error Control and Flow control, Multiplexing and Crash recovery.

Internet Transport Protocols (TCP and UDP): Introduction to UDP, Remote Procedure Call (RPC), Real-Time Transport Protocols, The TCP service model, The TCP protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, TCP Connection Management Modeling, TCP Sliding Window, TCP Timer management, TCP Congestion Control, Performance issues.

UNIT-V

Application Layer: The Domain Name System- DNS Name Space, Domain Resource Records, Name Servers, Electronic Mail-Architecture and Services, The User Agent, Message Transfer, SMTP and Extensions, Final Delivery,

Network Security: Introduction to Cryptography, Substitution Ciphers, Transposition Ciphers, Symmetric Key Algorithms-The Data Encryption Standard (DES), Triple DES, Public Key Algorithm:RSA Algorithm, Digital Signatures:

Symmetric-Key Signatures, Public-Key Signatures, Message Digests, Authentication Protocols.

Text Books:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Pearson Education, 2014.
2. W. Richard Stevens, Unix Network Programming, Prentice Hall/Pearson Education, 2009.

Suggested Reading:

1. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cyber Security, CRC Press, 2013.
2. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, 5th Edition, Addison-Wesley, 2012.

Web Resources:

1. http://www.nptelvideos.in/2012/11/computer-networks.html
2. beej.us/guide/bgnet/output/print/bgnet_A4.pdf

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16ITC25

DATA WAREHOUSING AND DATA MINING

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

Course Objectives:
This course is introduced to
1. Familiarise the 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. Present different frequent pattern discovery methods.
4. Describe various classification and clustering techniques.
5. Minecomplex data types.

Course Outcomes:
Upon successful completion of this course, the students should be able to
1. Understand requirements of data warehousing and data mining to the decision support level of organizations.
2. Apply Pre-Processing techniques on various data formats to make it suitable for data mining algorithms.
3. Generate Association rules for the data.
4. Build models for Classification, prediction, and clustering.
5. Evaluate the performance of various data mining algorithms.
6. Understand mining of complex data.

Prerequisites:
Database Systems (16ITC17), Database Lab (IT 317).

UNIT-I
Introduction: What is Data mining? What kinds of data can be mined? What kinds of pattern can be mined? Major issues in data mining.
Getting to know your data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity.
Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT-II
Data Warehousing and Online Analytical Processing Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design

and Usage: A Business Analysis Framework for Data Warehouse Design, Data Warehouse Design Process, Data Warehouse Usage for Information Processing, Data Warehouse Implementation.
Mining Frequent Patterns, Associations and correlations: Basic Concepts, Frequent Item Set Mining Methods, Interesting patterns, Pattern Evaluation Methods.
Advanced Pattern Mining: Pattern Mining in Multilevel and multidimensional space.

UNIT-III
Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Introducing Ensemble Methods, Bagging, Boosting, Random Forests, Improving Classification Accuracy of Class-Imbalanced Data. **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: Cluster Analysis, Partitioning Methods, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, DBSCAN, Evaluation of Clustering.

UNIT-V
Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches
Data Mining Trends and Research Frontiers: Mining Complex Data Types: Mining Sequence Data: Mining Other Kinds of Data, Data Mining Applications, Data Mining and Society, Data Mining Trends.

Text Book:
1. Han J, Kamber M, Jian P "Data Mining: Concepts and Techniques", Third Edition, Elsevier, 2012.

Suggested Reading:
1. Pang-Ning Tan, Michael Steinback, Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2008.
2. M. Humphires, M.Hawkins, M.Dy,"Data Warehousing: Architecture and Implementation", Pearson Education, 2009.
3. Anahory, Murray, "Data Warehousing in the Real World", Pearson Education, 2008.
4. Kargupta, Joshi, etc., "Data Mining: Next Generation Challenges and Future Directions", Prentice Hall of India Pvt. Ltd, 2007.

Web Resources:
1. https://www.kdnuggets.com/
2. http://archive.ics.uci.edu/ml/index.php

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16ITC26

ARTIFICIAL INTELLIGENCE

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

Course Objectives:

This course is introduced to

1. Learn problem solving techniques.
2. Familiarize with knowledge representation and logical reasoning techniques used in Artificial Intelligence.
3. Learn probabilistic reasoning models on uncertain data.
4. Design machine learning and neural network systems.
5. Learnsyntax and semantics of the natural language.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Solve problems using Exhaustive and Heuristic Search Techniques.
2. Apply inference methods in propositional logic to prove statements.
3. Apply probabilistic reasoning models on uncertain data.
4. Apply classification and clustering techniques on data sets.
5. Understand the working of neural networks to store and process information
6. Understand syntax and semantics of the language and knowledge representations.

Prerequisites:

Discrete Structures and Applications (16ITC01), Fundamentals of Data Science (16ITC12).

UNIT-I

Introduction – The Foundations of AI, History of AI.

Intelligent agents – Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Solving problems by searching – Problem Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed Search Strategies, Heuristic Functions.

Adversarial search – Games, Optimal decisions in games, Alpha-Beta Pruning.
Constraint Satisfaction Problems- Defining constraint satisfaction Problems.

UNIT-II

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

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

UNIT-III

Quantifying Uncertainty- Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and its Use.
Probabilistic Reasoning - Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Exact Inference in Bayesian Networks.

Probabilistic Reasoning over Time-Time and Uncertainty, Inference in Temporal Models, Hidden Markov Models, Kalman Filters.

UNIT-IV

Learning from Examples- Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks, Nonparametric Models, Support Vector Machines.
Learning Probabilistic Models- Statistical Learning, Learning with Complete Data.
Learning with Hidden Variables: The EM Algorithm

UNIT-V

Natural Language Processing-Language Models, Text Classification, Information Retrieval, Information Extraction.
Natural Language for Communication-Phrase Structure Grammars, Syntactic Analysis, Augmented Grammars and Semantic Interpretation.

Text Books:

1. Russell, Norvig, "Artificial intelligence - A Modern Approach", Pearson Education, Third Edition, 2015.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning, 2011.

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Suggested Reading:

1. Nilsson, N., “Artificial Intelligence: A New Synthesis”, San Francisco, Morgan Kaufmann, 1998.
2. Rich, Knight, Nair: “Artificial intelligence”, Tata McGraw Hill, Third Edition, 2009.
3. Tom M. Mitchell, “Machine Learning”, McGraw Hill, 1997.
4. Kulkarni, Parag, Joshi, Prachi ,”Artificial Intelligence : Building Intelligent Systems”, PHI, 2015.
5. Peter Jackson, “Introduction to Expert Systems”, Third Edition, Pearson Addison Wesley, 1998.

Web Resources:

1. http://www.nptel.ac.in/courses/106105077/
2. https://www.coursera.org/specializations/machine-learning

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16ITC27

PRINCIPLES OF COMPILER DESIGN

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

Course Objectives:

This course is introduced to

1. Learn various phases of Compiler Design.
2. Design scanner and Parsers.
3. Develop Intermediate code and generate code for target machine.
4. Familiarize with machine dependent and machine independent optimization techniques.
5. Present the role of a symbol table and error recovery strategies.

Course Outcomes:

Upon successful completion of this course, the students should be able to

1. Understand various phases in the design of compiler.
2. Generate a lexical analyser.
3. Design top-down and bottom-up parsers.
4. Develop Syntax Directed Translation scheme and Generate Intermediate code for a language.
5. Develop algorithms to generate code for a target machine.
6. Understand Data flow Analysis and Apply the optimization techniques.

Prerequisites:

Programming and Problem Solving (16CSC01), Data Structures and Algorithms (16ITC02),

Theory of Automata (16ITC20).

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.

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UNIT-II

Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down parsing, Bottom-Up parsing, Introduction to LR Parsing, More powerful LR parsers, Using Ambiguous Grammars, Parser Generators.

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.

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.

Text Books:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman ,"Compilers: Principles, Techniques &Tools", Pearson Education, Second Edition, 2014.
2. Kenneth C Louden, "Compiler Construction: Principles and Practice", Cengage Learning.

Suggested Reading:

1. Keith D Cooper & Linda Torczon, "Engineering a Compiler", Morgan Kafman, Second Edition.
2. Dick Grune, Kees van Reeuwijk, Henri E. Bal , Ceriel J.H. Jacobs, Koen Langendoen ," Modern Compiler Design", Springer, Second Edition.

Web Resources:

1. http://nptel.ac.in/courses/106108113

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16ITE04

PRINCIPLES OF COMPUTER GRAPHICS

(Elective-II)

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

Course objectives:

This course is introduced to

1. Explain the core concepts of computer graphics.
2. Displaying two dimensional output primitives for raster graphics system.
3. Acquire knowledge about transformation techniques in 2D and 3D.
4. To learn various algorithms on clipping techniques.
5. To acquire knowledge about curve generation and animations.

Course outcomes:

Students who complete this course should be able to

1. Understand the core concepts of computer graphics.
2. Understand the techniques for performing 2D and 3D transformations.
3. Describe various techniques for clipping.
4. Demonstrate problem solving skills with application to computer graphics.
5. Understand graphics techniques for curve generation.
6. Explain fundamentals of shading and animation techniques.

Prerequisites: Engineering Mathematics-I (16MTC01)

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.

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 Books:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics C version", Second Edition, Pearson Education.
2. "Computer Graphics Principles & practice", second edition in C, Foley, VanDam, Feiner and Hughes, Pearson Education.

Suggested Reading:

1. "Computer Graphics" Second edition, Zhigandxiang, Roy Plastock, Schaum's outlines, Tata Mc- Graw hill edition.
2. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2nd edition.
3. "Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
4. Principles of Computer Graphics, ShaliniGovil, Pai, 2005, Springer.
5. Computer Graphics, Steven Harrington, TMH.

Web Resources:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IITDelhi/Computer%20Graphics/csmain.html

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16ITE06

OBJECT ORIENTED SYSTEM DEVELOPMENT USING UML

(Elective-II)

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

Course Objectives:

This course is introduced to:

1. Acquaint the student with the precise vocabulary and powerful notation used in Unified modeling language.
2. Describe the basic structural modeling concepts in UML.
3. Familiarize students with architectural modeling.
4. Explain the concepts of Unified software development process.
5. Acquaint the students with UML notations and discuss several case studies.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Understand the precise vocabulary and powerful notation used in Unified modeling language.
2. Provide comprehensive introduction to basic structural modeling in UML.
3. Develop the component and deployment diagrams in architectural modeling.
4. Understand the Unified software development process and apply to UML models.
5. Involve in analysis and design of UML models for various case studies.
6. Relate the applications of Unified process in UML modeling.

Prerequisites:

Object Oriented Programming (16ITC03), Software engineering (16ITC26)

UNIT-I

UML Introduction: Why we Model, Introducing the UML, Elements of UML. Basic Structural Modeling: Classes, Relationships, Common Mechanisms, Diagrams, Class Diagrams.

Advanced Structural Modeling: Advanced Classes, Advanced Relationships, Interfaces, Types and 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.

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Advanced BehavioralModeling: Events and Signals-types of events-internal and external events, 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, components of deployment diagrams-nodes and links, common modeling techniques for deployment diagrams-modeling a fully distributed system, modeling embedded systems, modeling client-server systems, Systems and Models- subsystems, trace relationships, Case studies on Deployment diagrams.

UNIT-IV

Unified Software Development Process: The Unified Process, phases in unified software development process-inception, elaboration, construction and transition, The Four P's-people, project, product, process, A Use-Case Driven Process-Importance of Use case modeling, An Architecture-Centric Processes, base lining the architecture, An Iterative and Incremental Process-a generic iteration, advantages of iterative and incremental process.

UNIT-V

Core Workflows: Requirements Capture, Capturing Requirements as Use Cases, Analysis-role of analysis in software life cycle, artifacts, workers and activities in analysis workflow, Design-workers, artifacts and activities in design workflow, Implementation-role of implementation in software life cycle, Test, testing artifacts-test case, test plan, test procedure.

Text Books:

1. Grady Booch, James Rumbaugh, Ivor Jacobson, "The Unified Modeling Language-User Guide (Covering UML 2.0)", Third Edition, Pearson Education, India, 2010.
2. Ivor Jacobson, Grady Booch, James Rumbaugh, "The Unified Software Development Process", second edition ,Pearson Education, India, 2008.

Suggested Reading:

1. Martin Fowler, Kendall Scott "UML Distilled**:** A Brief Guide to the Standard Object Modeling Language" Addison Wesley, Fourth Edition, 2011.
2. Hans van Vliet "Software Engineering Principles and Practice", Second Edition, 2010.

Web Resources:

1. IBM Rational http://www-306.ibm.com/software/rational/uml/
2. Practical UML - A Hands-On Introduction for Developers http://www.togethersoft.com/services/practical_guides/umlonlinecourse/
3. http://www-inst.eecs.berkeley.edu/~cs169/

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16ITE07

DIGITAL IMAGE PROCESSING

(Elective-III)

Instruction	3LHours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 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.
3. To learn the image analysis concepts: morphological image processing, image segmentation, image representation and description, and object recognition.
4. To understand colour image processing techniques.
5. To learn various image compression methods.

Course Outcomes:

Upon successful completion of the course, student will be able to

1. Explain the fundamental concepts and discuss the applications of digital image processing.
2. Explain intensity transformations, spatial filtering, smoothing and sharpening in both spatial and frequency domains, image restoration and reconstruction.
3. Demonstrate the image analysis concepts like morphological image processing, image segmentation, image representation and description, and object recognition.
4. Illustrate colour image processing techniques.
5. Distinguish and describe various image compression methods.

Prerequisites:

Engineering Mathematics- I (16MTCO1)

UNIT-I

Basics: Introduction, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of visual perception, Image Sampling and Quantization - Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Intensity Resolution;

Some Basic Relationships between Pixels - Neighbours of a Pixel, Adjacency, Connectivity, Regions, and Boundaries, Distance Measures
Intensity Transformations: Some Basic Intensity Transformation Functions, Image Negatives, Log Transformations, Power-Law (Gamma) Transformations, Piecewise-Linear Transformation Functions, Histogram Processing - Histogram Equalization, Histogram Matching (Specification), Local Histogram Processing.

UNIT- II

Spatial Filtering: Fundamentals of Spatial Filtering, The Mechanics of Spatial Filtering, Spatial Correlation and Convolution, Smoothing Spatial Filters - Smoothing Linear Filters, Order-Statistic (Nonlinear) Filters; Sharpening Spatial Filters – Foundation, Using the Second Derivative for Image Sharpening—The Laplacian, Unsharp Masking and Highboost Filtering.

Filtering in the Frequency Domain: The 2-D Discrete Fourier Transform and its inverse, Some Properties of the 2-D Discrete Fourier Transform - Relationships Between Spatial and Frequency Intervals, Translation and Rotation, Periodicity, Symmetry Properties, Fourier Spectrum and Phase Angle, The 2-D Convolution Theorem.

The Basics of Filtering in the Frequency Domain - Frequency Domain Filtering Fundamentals Correspondence Between Filtering in the Spatial and Frequency Domains, Image Smoothing Using Frequency Domain Filters, Ideal Low pass Filters, Butterworth Low pass Filters, Gaussian Low pass Filters, Image Sharpening Using Frequency Domain Filters - Ideal High pass Filters, Butterworth High pass Filters, Gaussian High pass Filters, The Laplacian in the Frequency Domain, Unsharp Masking, Highboost Filtering.

UNIT- III

Image Restoration and Reconstruction: A Model of the Image Degradation/ Restoration Process, Noise Models - Spatial and Frequency Properties of Noise, Some Important Noise Probability Density Functions, Periodic Noise, Estimation of Noise Parameters, Restoration in the Presence of Noise Only—Spatial Filtering, Mean Filters, Order-Statistic Filters, Adaptive Filters; Periodic Noise Reduction by Frequency Domain Filtering – Band reject Filters, Band pass Filters; Estimating the Degradation Function - Estimation by Image Observation, Estimation by Experimentation, Estimation by Modelling; Inverse Filtering; Minimum Mean Square Error (Wiener) Filtering; Constrained Least Squares Filtering.

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing.

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UNIT- IV

Image Segmentation:Fundamentals, detection of isolated points, line detection, basic edge detection, edge linking and boundary detection; thresholding – foundation, basic global thresholding, optimum global thresholding using otsu's method; region-based segmentation - region growing, region splitting and merging; segmentation using morphological watersheds - background, dam construction, watershed segmentation algorithm.

Representation and Description: Representation-Boundary (Border) Following, Chain Codes, Polygonal Approximations Using Minimum-Perimeter Polygons, Signatures, Boundary Descriptors - Some Simple Descriptors, Shape Numbers, Fourier Descriptors, Statistical Moments, Regional Descriptors - Some Simple Descriptors, Topological Descriptors, Texture.

Object Recognition: Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods – Matching, Optimum Statistical Classifiers, Neural Networks.

UNIT-V

Colour Image Processing: Colour Fundamentals; Colour Models - RGB Colour Model, CMY and CMYK Colour Models, The HSI Colour Model; Pseudo colour Image Processing - Intensity Slicing, Intensity to Colour Transformations; Basics of Full-Colour Image Processing - Colour Transformations, Colour Edge Detection

Image Compression: Fundamentals-Coding Redundancy, Spatial and Temporal Redundancy, Irrelevant Information, Measuring Image Information, Fidelity Criteria, Image Compression Models - Image Formats, Containers, and Compression Standards; Some Basic Compression Methods - Huffman Coding, Arithmetic Coding, LZW Coding, Block Transform 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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16ITE08

INFORMATION RETRIEVAL SYSTEMS
(Elective – III)

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

Course Objectives:

This course is introduced to

1. To familiarize the different Information Retrieval models.
2. To understand how to write query languages and evaluation.
3. To build index and perform compression on the data.
4. To familiarize pattern matching algorithms.
5. To learn parallel and distributes models.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Understand different Information Retrieval models.
2. Understand the query language to retrieve the data.
3. Analyse and improve the retrieval results.
4. Understands the operations on the text data and builds index of the data.
5. Apply different pattern matching algorithms on text data.
6. Understand parallel and distributed Information Retrieval models.

Prerequisites:

Database Systems (16ITC17), Data Warehousing and Data Mining (16ITC25).

UNIT-I

Introduction: Basic concepts, Past present and Future of IRS, Retrieval Process. Modeling: Introduction, A Taxonomy of IR Models, Retrieval: Adhoc and Filterig, A formal characterization of IR Models, Classic IR, Set Theoretic Models, Algebraic Models, Probabilistic Models.

UNIT-II

Structured Text Retrieval Models, Models for Browsing.

Retrieval Evaluation: Introduction, Reference Collections.

Query languages: Introduction, Keyword-based querying, pattern Matching, Structural Queries, Query Protocols.

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UNIT-III

Query operations: Introduction, User Relevance Feedback, Automatic Local Analysis, Automatic Global Analysis.

Text and Multimedia Languages and Properties: Introduction, Meta Data, Text, Markup Languages, Multimedia.

UNIT-IV

Text operations: Introduction, Document Preprocessing, Document Clustering, Text Compression, Comparing Text Compression Techniques Indexing: Introduction, Inverted Files, Other Indices for Text Searching, Boolean Queries.

UNIT-V

Searching: Sequential Searching, Pattern Matching, Structural Queries, Compression Parallel and Distributed IR: Introduction, Parallel IR, Distributed IR.

Text book:

1. Ricardo, Baeza-yates, BerthierRibeiro-Neto, "Modern Information Retrieval" Pearson Education, 2008.

Suggested Reading:

1. Christopher D. Manning and PrabhakarRaghavan and HinrichSchütze, "Introduction to
2. Information Retrieval", Cambridge University Press, 2009.
3. David A. Grossman, OphirFrieder, "Information Retrieval - Algorithms and Heuristics", Springer, 2nd Edition (Distributed by Universities Press), 2004.
4. Gerald Kowalski, "Information Retrieval Systems: Theory and Implementation", Springer.
5. William B. Frakes, Ricardo Baeza- Yates, "Information Retrieval – Data Structures & Algorithms", Pearson Education, 2008.

Web Resources:

1. https://class.coursera.org/nlp/lecture
2. http://www.dcs.gla.ac.uk/Keith/Preface.html

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16ITE09

E-COMMERCE

(Elective-III)

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

Course Objectives:

This course is introduced to

1. Analyze features of existing e-commerce businesses, and propose future directions or innovations for specific businesses.
2. To understand the role of multimedia in E-Commerce and security issues of E-Commerce.
3. Discuss electronic commerce and the stakeholders and their capabilities and limitations in the strategic convergence of technology and business.
4. Identify advantages and disadvantages of technology choices such as merchant server software and electronic payment options.
5. To understand the Emerging tools for Resource search and discovery.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Able to implement e-commerce in business applications.
2. To make effective use of multimedia in E-commerce applications.
3. To resolve security issues in Electronic Payment Systems.
4. Able to describe the Document infrastructure for E-commerce and advertisement in Market.
5. To make use of emerging tools in Resource search and discovery.
6. Be aware of global perspectives (needs, rules/regulations, and specifications).

UNIT-I

Introduction: Electronic commerce and Physical Commerce, different type of ecommerce, some e-commerce scenario, Advantages of e-commerce.

Basic technologies of Ecommerce: Client side Programming, Server Side Programming, Database connectivity, session tracking techniques.

UNIT-II

Internet Payment System: Characteristics of payment system, SET Protocol for creditcard payment, E-cash, E-check, Micropayment system.

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E-commerce strategies: Strategies for marketing, Sales and Promotions, Strategies forPurchasing and support activities, Strategies for Web Auctions, Virtual Communities,and web portals.

UNIT -III

E-Business -Introduction: E-Business vs E-commerce,, Characteristics of e-Business, e-Business role and their challenges, e-business Requirements, impacts of e-business.

E-business strategies: Strategic positioning, Levels of e-business strategies, Strategicplanning process, Strategic alignment, the consequences of e-Business, Success factorsfor implementation of e-business strategies. Business models, Business process and collaborations.

UNIT-IV

Advance technologies of E-commerce: Mobile Agent, WAP, XML, Data Mining, RichInternet Application, Web 2.0, REST Web Services, Web Mashup, Working of SearchEngines, Internet Security.

UNIT- V

Integration of Application: Approaches to Middleware, RPC and RMI, EnterpriseApplication Integration, e-business Integration, loosely Coupled e-Business solutions forintegration, Service Oriented Architecture, EAI and web Services, WS-security.

Text Books:

1. E-Commerce Fundamentals and application (Henry Chan) Wiley publication.
2. Electronic Commerce (Gary Schneider) Thomson Course technology.
3. E-Business Organizational and technical foundation (Michael P) Wiley Publication.

Suggested Reading:

1. E- Commerce Strategies, Technology and applications (David) Tata McGraw-Hill.
2. Introduction to E-commerce (Jeffrey) Tata- McGraw-Hill.
3. E-Business and Commerce- Strategic Thinking and Practice (Brahm) biztantra.

Web Resources:

1. http://www.w3schools.com/xml/default.asp
2. http://www.tizag.com/xmlTutorial/
3. https://www.practicalecommerce.com/

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16ITC28

NETWORK PROGRAMMING LAB

Instruction	3LHours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

This course is introduced to

1. Familiarize students with client/server architecture in application development.
2. Provide understanding of elementary socket system calls, advanced socket system calls.
3. Expose students to the usage of TCP and UDP based sockets.
4. Provide knowledge of network routing algorithms and application layer protocols.
5. Cryptographic principles and encryption algorithms.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Use elementary socket system calls and develop distributed applications.
2. Model and evaluate performance of networking systems.
3. Implement the Routing algorithms.
4. Develop and implement next generation protocols required for emerging applications.
5. Understand the operating principles of Electronic Mail (SMTP), HTTP.
6. Comprehend various network security threats and implement the cryptographic algorithms.

Prerequisites:

Programming and Problem Solving (16CSC01), Java Programming (16ITC10).

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 getsockopt(), 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 HTTP.
10. Implementation of RSA algorithm.
11. Develop an Internet Mail Application.
12. Multimedia file transmission using FTP.

Note: Implement programs 2 to 7 in C and 8 to 12 in JAVA.

Text Book:

1. W. Richard Stevens, "Unix Network Programming", Prentice Hall, Pearson Education, 2009.

Suggested Reading:

1. Douglas E.Comer, "Hands-on Networking with Internet Technologies", Pearson Education.
2. James Kurose and Keith Ross. Computer Networking: A Top-Down Approach Featuring the Internet.

Web Resources:

1. https://in.udacity.com/course/computer-networking—ud436
2. https://www.mooc-list.com/course/learn-socket-programming-tutorial-c-scratch-eduonix.

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16ITC29

DATA MINING LAB

Instruction	3LHours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

This course is introduced to

1. Weka tool and R-Tool for data mining.
2. Present various pre-processing techniques.
3. Familiarise with data visualization.
4. Acquaint various features available in weka for mining interesting patterns.
5. Present various mining techniques to analyse the data in R - Tool.

Course Outcomes:

Upon successful completion of this course, student will be able to

1. Describe the data using various visualisation techniques.
2. Identify and apply necessary pre-processing techniques on raw data.
3. Generate interesting patterns using appropriate data mining techniques.
4. Perform pattern evaluation.
5. Visualise the knowledge mined.
6. Build a data mining system for a given application.

Prerequisites:

Database Systems (16ITC17)

List of Programs

I. Introduction to data mining using Weka and R-Tool.

II. Experiment the following in Weka Tool.

1. Perform the following Preprocessing operations:
    - i. Attribute selection
    - ii. Handling missing values
    - iii. Discretisation
    - iv. Converting nominal attributes to binary attributes
    - v. Normalisation
    - vi. Standardisation
    - vii. Outlier detection and elimination.

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2. Generate Association Rules using Apriori and FP Growth algorithms.
3. Build the following classifiers and check their efficiency:
   - i. Decision Tree
   - ii. Naïve Bayes
   - iii. Bagging
   - iv. AdaBoost
   - v. Random forest
   - vi. K-NN
4. Apply the following clustering algorithms on datasets and visualise the clusters
   - i. K-Means
   - ii. Hierarchical
   - iii. DBSCAN
5. Build Linear Regression model.

III. Experiment the following in R-Tool:
1. Data Import/Export
2. Data Exploration and Visualization
3. Association Rule Mining
4. Regression and Classification
5. Data Clustering
6. Text Mining with R: Twitter Data Analysis
7. Time Series Analysis and Mining

(Note: Wherever necessary interpret the results and measure the performance)

Text Books:

1. Ian H.Witten, EibeFank, Mark A Hall, “Data Mining Practical Machine Learning Tools and Techniques”, Third edition, 2011.
2. Pawel Cichosz, “Data Mining Algorithms: Explained Using R”, Wiley (2015).

Suggested Reading:

1. Han J, Kamber M, Jian P “Data Mining: Concepts and Techniques”, Third Edition, Elsevier, 2012.
2. Yanchang Zhao, “R and Data mining: Examples and Case Studies”, First Edition, Elsevier 2012.

Web Resources:

1. https://www.cs.waikato.ac.nz/ml/weka/
2. http://www.rdatamining.com/
3. http://illimine.cs.uiuc.edu/
4. https://www.kdnuggets.com/
5. http://archive.ics.uci.edu/ml/index.php

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16ITC30

MINI PROJECT – IV

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

Course Objectives:

1. To enable students learn by doing.
2. To develop capability to analyze and solve real world problems.
3. To develop innovative ideas among the students.

Course Outcomes:

Students should be able to do the following:

1. To provide innovative solutions.
2. To work in a team.
3. To manage time and resources in the best possible manner.

The Students are required to implement one of the projects from project exercise given in the suggested readings of the theory subjects of the current semester / as suggested by the respective course faculty of that semester. 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 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

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/

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.

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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.

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;

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.

Head D

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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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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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", 4th 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.

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 a [illegible] mbedded Software Development Tools: Host and Target machin[illegible] mbedded

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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.

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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, Tim ... ates and Times.

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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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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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.

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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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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 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 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 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.

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

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 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, 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 6105

INFORMATION RETRIEVAL 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 get

1. familiarized the different IR models.
2. to develop an overall understanding of the different text retrieval models, query languages and query evaluation
3. to develop a thorough understanding of the technical details of the important processes such as indexing, compression and searching.

Course outcomes:

Upon successful completion of the course

1. Have obtained sufficient theoretical background to develop efficient Information retrieval systems.
2. Have gained sufficient insight which would help in conducting research in the area.

UNIT-I

Introduction: Basic concepts, Past present and Future of IRS, Retrieval Process. Modeling: Introduction, A Taxonomy of IR Models, Retrieval: Adhoc and Filterig, A formal characterization of IR Models, Classic IR, Set Theoretic Models, Algebraic Models, Probabilistic Models

UNIT-II

Structured Text Retrieval Models, Models for Browsing
Retrieval Evaluation: Introduction, Reference Collections.
Query languages: Introduction, Keyword-based querying, pattern Matching, Structural Queries, Query Protocols.

UNIT-III

Query operations: Introduction, User Relevance Feedback, Automatic Local Analysis, Automatic Global Analysis.
Text and Multimedia Languages and Properties: Introduction, Meta Data, Text, Markup Languages, Multimedia.

UNIT-IV

Text operations: Introduction, Document Preprocessing, Document Clustering, Text Compression, Comparing Text Compression Techniques.
Indexing: Introduction, Inverted Files, Other Indices for Text Searching, Boolean Queries,

UNIT-V

Searching: Sequential Searching, Pattern Matching, Structural Queries, Compression.

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Parallel and Distributed IR: Introduction, Parallel IR, Distributed IR.

Suggested Reading:

1) Ricardo, Baeza-yates, BerthierRibeiro-Neto, “Modern Information Retrieval” Pearson Education, 2008
2) David A. Grossman, OphirFrieder, "Information Retrieval - Algorithms and Heuristics", Springer, 2nd Edition (Distributed by Universities Press), 2004.
3) Gerald Kowalski, “Information Retrieval Systems: Theory and Implementation”, Springer.
4) William B. Frakes, Ricardo Baeza- Yates, “Information Retrieval – Data Structures & Algorithms”, Pearson Education, 2008.

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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

I**nter 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.

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 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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19IT E110

BIG DATA ANALYTICS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce big data and HDFS.
2. To impart knowledge on Mapper and Reducer.
3. To provide the concepts of NoSQL and MongoDB.
4. To introduce programming tools PIG and HIVE in Hadoop echo system.
5. To facilitate learning of Spark with machine learning applications.

Course Outcomes: Upon completing this course, students will be able to:

1. Perform data processing in Hadoop framework.
2. Build applications using MapReduce.
3. Model the data using NoSQL and MongoDB.
4. Explore big data applications using Pig and Hive.
5. Develop machine learning solutions in Spark.

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UNIT-I

Introduction to Big Data: Big Data Important, 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.

UNIT-II

MapReduce: What is Map reduce, Architecture of map reduce.
How MapReduce Works: Anatomy of a MapReduce Job Run, Job Submission, Job Initialization, Task Assignment, Task Execution, Progress and Status Updates, Job Completion, Failures, Task Failure, Application Master Failure, Node Manager Failure, Resource Manager Failure, Shuffle and Sort, The Map Side, The Reduce

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Side, **MapReduce Types and Formats:** MapReduce Types, The Default MapReduce Job, Input Formats, Input Splits and Records, Text Input, Output Formats, Text Output, Developing a MapReduce Application.
Hadoop Ecosystem and YARN: Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New Features NameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

UNIT-III
No SQL Databases: Review of traditional Databases, Need for NoSQL Databases, Columnar Databases, Failover and reliability principles, CAP Theorem, Differences between SQL and NoSQL databases, **Working Mechanisms of Mongo DB**: Overview, Advantages, Environment, Data Modelling, Create Database, Drop Database, Create collection, Drop collection, Data types, Insert, Query, Update and Delete operations, Limiting and Sorting records, Indexing, Aggregation

UNIT-IV
Pig: Generating Examples, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators, Pig in Practice.
Hive: Comparison with Traditional Databases, HiveQL, Tables, Querying Data, User-Defined Functions, Writing a User Defined Functions, Writing a User Defined Aggregate Function.

UNIT-V
Spark: Spark and its Purpose, Components of the Spark Unified Stack, Batch and Real-Time Analytics with Apache Spark, Resilient Distributed Dataset, Scala (Object Oriented and Functional Programming)
Machine Learning with Spark: Designing a Machine Learning System, Obtaining, Processing and Preparing Data with Spark, Building a Recommendation Engine with Spark, Building a Classification Model with Spark, Building a Regression Model with Spark and Building a Clustering Model with Spark.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", Fourth Edition, O'Reilly Media Inc, 2015.
2. Nick Pentreath, "Machine Learning with Spark", First Edition, Packt Publishing, 2015.

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Suggested Reading:

1. Thilinagunarathne, “Hadoop MapReduce v2 Cookbook”, Second Edition, Packet Publishing, 2015.
2. Chuck Lam, Mark Davis, Ajit Gaddam, “Hadoop in Action”, Manning Publications Company, 2016.
3. Alex Holmes, “Hadoop in Practice”, Manning Publications Company, 2012.
4. Alan Gates, “Programming Pig”, O’Reilly Media Inc, 2011.
5. Edward Capriolo, Dean Wampler, Jason Rutherglen, “Programming Hive”, O’Reilly Media Inc, 2012.

Web Resources:

1. http://www.planetcassandra.org/what-is-nosql
2. https://stanford.edu/~rezab/sparkworkshop/slides/xiangrui.pdf
3. https://class.coursera.org/datasci-001/lecture

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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.

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.

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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 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.

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 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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19IT E116

BIG DATA ANALYTICS LAB

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Objectives:

1. To introduce Hadoop Cluster setup and MapReduce.
2. To present Pig and HiveQL to process big data.
3. To impart knowledge to work with NoSQL databases.
4. To familiarise with Spark framework.
5. To facilitate learning of processing large datasets in Hadoop and visualize its results in R (RHadoop).

Course Outcomes: Upon completing this course, students will be able to:

1. Setup Hadoop cluster and develop applications using Map Reduce.
2. Write scripts using Pig to solve real world problems and queries the datasets using Hive.
3. Write NoSQL queries for large datasets.
4. Work in Spark environment.
5. Analyse and visualise applications in R language and Hadoop.

List of Programs

1. Understanding and using basic HDFS commands.
2. Word count application using Mapper Reducer on single node cluster.
3. Analysis of Weather Dataset on Multi node Cluster using Hadoop.
4. Real world case studies on Map Reduce applications.
5. Working with files in Hadoop file system: Reading, Writing and Copying.
6. Writing User Defined Functions/Eval functions for filtering unwanted data in Pig.
7. Working with HiveQL.
8. Writing User Defined Functions in Hive.
9. Understanding the processing of large dataset on Spark framework.
10. Integrating Hadoop with other data analytic framework like R.

Text Books:

1. Tom White, “Hadoop: The Definitive Guide”, Fourth Edition, O’Reilly Media Inc, 2015.

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2. Nick Pentreath, “Machine Learning with Spark”, First Edition, Packt Publishing, 2015.
3. Tanmay Deshpande, “Hadoop Real-World Solutions Cookbook”, Second Edition, Packt Publishing 2016.

Suggested Reading:

1. Edward Capriolo, Dean Wampler, and Jason Rutherglen, “Programming Hive”, O’Reilly Media, 2012.
2. Vignesh Prajapati, “Big data Analytics with R and Hadoop”, Packt Publishing, November 2013.

Web Resources:

1. https://parthgoelblog.wordpress.com/tag/hadoop-installation
2. http://www.iitr.ac.in/media/facspace/patelfec/16Bit/index.html
3. https://class.coursera.org/datasci-001/lecture
4. http://bigdatauniversity.com.
5. https://doc.lagout.org/science/Artificial%20Intelligence/Machine%20learning Machine%20Learning%20with%20Spark%20%5BPentreath%202014-12-08%5D.pdf

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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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19IT C106

MINI PROJECT with SEMINAR

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Outcomes: Upon completing this course, students will be able to:

1. Formulate a specific problem and give solution.
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions.
4. Conclude the results obtained.
5. Write the documentation in standard format.

Guidelines:

- As part of the curriculum in the II- semester of the programme each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
- Each student will be allotted to a faculty supervisor for mentoring.
- Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
- Mini projects shall have inter disciplinary/ industry relevance.
- The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
- All the investigations are clearly stated and documented with the reasons/explanations.
- The mini-project shall contain a clear statement of the research objectives, background of the work, literature review, techniques used, prospective deliverables, detailed discussion on results, conclusions and references.

Department committee: Supervisor and two faculty coordinators

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Guidelines for awarding marks (CIE):		Max. Marks: 50
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
B.E (EEE)

SEMESTER – I

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
	THEORY								
1	18MT C01	Mathematics - I	3	1	-	3	30	70	4
2	18PY C04	Waves, Optics and Introduction To Quantum Mechanics	3	1	-	3	30	70	4
3	18CS C01	Programming for Problem Solving	3	-	-	3	30	70	3
4	18EG C01	English	2	-	-	2	20	50	2
	PRACTICALS								
5	18PY C07	Waves and Optics Laboratory	-	-	3	3	25	50	1.5
6	18CS C02	Programming and Problem Solving Lab	-	-	4	3	25	50	2
7	18ME C02	Workshop/ Manufacturing Practice	1	-	4	3	25	50	3
8	18EG C02	English Lab	-	-	2	2	15	35	1
		Total	**12**	**02**	**13**	**-**	**200**	**445**	**20.5**

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

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18MT CO1

MATHEMATICS– I

(Common to all branches and except for Bio-Tech)

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

Course Objectives:

1. To solve linear system of equations using Matrix Methods.
2. To know the convergence of the Series.
3. To represent the function in series form.
4. To know the Partial Derivatives and use them to interpret the way a function of two variables behaves.
5. To learn Vector Differential Operator and its Physical interpretations on Scalars and vector functions.
6. To solve improper integrals.

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 vectors in engineering problems.
2. Check the series convergence.
3. Find the evolutes of the given curves.
4. Expand and find extreme values of functions of two variables.
5. Understanding the significance of gradient, divergence and curl.
6. An ability to solve the problems and interpret in geometrical approach.

UNIT-I: Matrices:

Rank of the matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Eigenvalues, Eigenvectors, Properties of eigenvalues, Cayley-Hamilton theorem, Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic forms.

UNIT-II: Sequences and Series:

Definition of Convergence of sequence and series. Tests for convergence of series: comparison test, limit comparison test, D'Alembert ratio test, Raabe's test, Cauchy's n^{th} root test, logarithmic test, alternative series, absolute and conditional convergence.

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UNIT- III: Calculus:

Rolle's Theorem, Lagranges Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, radius of curvature, Evolutes and involutes ,
Fourier series, half range sine and cosine series

UNIT-IV: Multivariable Calculus (Differentiation):

Functions of two variables, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions two variables, Lagrange's multipliers method.

UNIT-V: Vector Calculus (Differentiation):

Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, vector identities. Improper integrals: Beta and Gamma functions and their properties.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

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18PY C04

WAVES, OPTICS AND INTRODUCTION TO QUANTUM MECHANICS
(for EEE only)

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

Course Objectives:
The objectives of the course is to make the student
1. Understands the fundamentals of oscillations.
2. Learns the basic concepts of wave nature of light.
3. Acquires knowledge of lasers and fibre optics.
4. Familiar with Quantum Mechanics.
5. Learns the fundamentals of solids and semiconductors.

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. Describe the types of lasers and optical fibres and their applications.
4. Demonstrate the important concepts of Quantum Mechanics.
5. Identify the electronic materials for engineering applications.

UNIT -I: Waves:
Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator, forced mechanical and electrical oscillators, impedance, steady state motion of forced damped harmonic oscillator.

UNIT-II: Wave Optics:
Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach Zehnder interferometer. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

UNIT-III:
Lasers: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity.

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Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, pulse dispersion, application of optical fibres.

UNIT- IV

Introduction to Quantum Mechanics: Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wave function, Born interpretation, probability current, Expectation values, Free-particle wave function and wave-packets, Uncertainty principle.

Solution of Wave Equation: Solution of stationary-state Schrodinger equation for one dimensional problems–particle in a box, particle in attractive delta-function potential, square-well potential.

UNIT-V: Introduction to Solids and Semiconductors:

Free electron theory of metals, Fermi level, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands. Types of electronic materials: metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p -n junction.

TEXT BOOKS:

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

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publi., 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 Limited; 6th Revised edition, 2015.

18CS C01

Programming for Problem Solving
(Common to All Programs)

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

Course Objectives

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

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

1. Identify the computing environments.
2. Formulate solutions to problems and represent them using algorithms/ Flowcharts.
3. Choose proper control statements and data structures to implement the algorithms.
4. Trace the programs with test the program solution
5. Decompose a problem into modules and use functions to implement the modules.
6. Develop applications using file I/O.

UNIT -I

Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

Introduction to programming: Programming languages and generations, categorization of high level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence and associativity.

UNIT – II

Introduction to decision control statements: Selective, looping and nested statements.

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Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes.

Case study:

UNIT – III

Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting(selection and Buble) algorithms, 2-D arrays, matrix operations.

Strings: Introduction, stringsrepresentation, string operations with examples.

Case study:

UNIT – IV

Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, function pointers, array of function pointers, dynamic memory allocation, advantages and drawbacks of pointers

Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions and enumerated data types.

UNIT-V

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

Preprocessor Directives: Types of preprocessor directives, examples.

Suggested Reading:

1. A K Sharma "**Computer Fundamentals and Programming**", 2nd Edition, University Press, 2018.
2. Pradeep Dey and Manas Ghosh, "**Programming in C**", Oxford Press, 2nd Edition, 2017.

References:

1. Byron Gottfried, Schaum's"**Outline of Programming with C**", McGraw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press,2015.
5. https://www.tutorialspoint.com/cprogramming/index.htm
6. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

18EG C01
ENGLISH

(Common to all Branches)

Instruction	2Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	20 Marks
Credits	2

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 equip the students with basics of writing correct sentences to coherent paragraphs.
3. To equip the students with techniques of writing a précis and an essay by using accurate grammar and appropriate vocabulary.
4. To train the students to describe, define and classify processes and to draft formal reports by adhering to the proper structure.
5. To develop the reading skills and reading comprehension techniques of the students.
6. To develop the students reading, writing, grammatical, lexical and communicative competence.

Course Outcomes:

1. The students will understand the nature, process and types of communication and will communicate effectively without barriers.
2. The students will write correct sentences and coherent paragraphs.
3. The students will know how to condense passages by writing précis and write essays by using accurate grammar and appropriate vocabulary.
4. The students will demonstrate advanced writing skills by drafting formal reports.
5. The students will apply their reading techniques and analyze reading comprehension passages.
6. The students will become effective communicators and will display their advanced skills of reading and writing and use correct grammar and appropriate vocabulary in all contexts.

UNIT-I Understanding Communication in English:

Introduction, nature and importance of communication.Process of communication.Basic types of communication - verbal and non-verbal.Barriers to communication.Intrapersonal and interpersonal communication.Johari Window.

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Vocabulary & Grammar: The concept of Word Formation. Importance of proper punctuation.Articles.

UNIT-II Developing Writing Skills I:
Types of sentences. Use of phrases and clauses in sentences.Cohesion and coherence.Paragraph writing. Organizing principles of paragraphs in documents. Vocabulary & Grammar: Cohesive devices. Root words from foreign languages and their use in English. Prepositions.

UNIT-III Developing Writing Skills II:
Techniques for writing precisely. Précis Writing. Essay Writing.
Vocabulary and Grammar: Subject-verb agreement, Noun-pronoun agreement Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Redundancies, Clichés.

UNIT-IV Developing Writing Skills III:
Describing, Defining, Classifying, Providing examples or evidence.Writing introduction and conclusion.
Report writing – Importance, structure and elements of style of formal reports.
Vocabulary and Grammar: Misplaced modifiers. Synonyms, antonyms.

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

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

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

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18PY C07

WAVES AND OPTICS LABORATORY
(for EEE only)

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

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 semiconductor 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. Understand the applications of semiconductor materials.
4. Demonstrate the uses of optical instruments.
5. Use LCR circuits in different applications.

Experiments

1. Error analysis – Estimation of errors in the determination of time period of a torsional pendulum.
2. Melde's experiment.
3. μ of lenses.
4. Newton's rings – Determination of wavelength of given monochromatic source.
5. Single slit diffraction – Determination of wavelength of given monochromatic source.
6. Resolving power of telescope.
7. Cauchy's constants.
8. Laser – Determination of wavelength of given semiconductor red laser.
9. Diffraction Grating – Determination of wavelengths of two yellow lines of mercury light.
10. Viscosity by oscillating disc (Lamp scale method).
11. Hall effect – Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen.
12. Energy gap – Determination of energy gap of given semiconductor.
13. Thermistor – Determination of temperature coefficient of resistance of a given thermistor.

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14. LCR circuit (Parallel & Series).
15. Optical fibre – Determination of NA and power losses of given optical fibre.

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.
4. Indu Prakash, Ram Krishna and A.K. Jha, *A Text Book of Practical Physics*, Kitab Mahal Publications, 2012.

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18CS C02

Programming for Problem Solving
(Programming Lab – I)
(Common to All Programs)

Instruction	4 Periods per week
Duration of Semester-End Examination	3 Hours
Semester-End Examination	50 Marks
Sessional	25 Marks
Credits	2

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

Course Outcomes:
At the end of the course students will be able to:
1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Identify and rectify the syntax errors and debug program for semantic errors.
4. Analyze the results to evaluate the solutionsof the problems.
5. Solve problems in amodular approach using functions.
6. Implement file operations with simple text data.

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

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Design the experiments in such a way that the students will be able to end up the solution for a real world problem that uses most of the concepts of C programming language.
For example: A banking application where it uses the concepts of operators, control structures, switch case for menu, structures, functions, error handling, files etc.

Suggested Reading:

1. Pradeep Dey and Manas Ghosh, "**Programming in C"**, Oxford Press, 2nd Edition, 2017
2. ReemaTharaja "**Introduction to C Programming**", Second Edition, OXFORD Press, 2015

References:

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

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18ME C02

WORKSHOP/ MANUFACTURING PRACTICE

Instruction	1T+4P Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation:	25 Marks
Credits	3

Course Objectives:

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

Course Outcomes – (Laboratory): Student will be able to

1. Fabricate components with their own hands.
2. Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. Assembling different components, student will be able to produce small mechanisms/devices of their interest.
4. Gain practical skills of carpentry, tinsmithy, fitting, house wiring
5. Gain knowledge of different Engineering Materials and Manufacturing Methods.
6. Understand trades and techniques used in Workshop and chooses the best material/ manufacturing process for the application.

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18EG C02

ENGLISH LAB

(Common to all Branches)

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:

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. The students will enhance their listening skills by practicing IELTS and TOEFL material.
5. To help students overcome their inhibitions while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
6. To help students to understand team work, role behavior and to develop their ability to discuss in groups and make oral presentations.

Course Outcomes:

1. The students will differentiate the speech sounds in English.
2. The students will interact with the software and understand the nuances of pronunciation in English.
3. The students will speak with the proper tone, intonation and rhythm and apply stress correctly.
4. The students will demonstrate their listening skills by analyzing the IELTS and TOEFL listening comprehension texts
5. The students will speak with clarity and confidence.
6. The students will work in teams and discuss various topics and demonstrate their presentation skills through posters.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.

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4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – practice with IELTS and TOEFL material.
6. **Situational dialogues and role play –** Dialogue writing, **–** Role behavior and role enactment.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
9. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

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

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SEMESTER – II

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
	THEORY								
1	18MT C03	Mathematics -II	3	1	-	3	30	70	4
2	18CY C01	Chemistry	3	1	-	3	30	70	4
3	18CE C01	Engineering Mechanics	3	1	-	3	30	70	4
4	18ME C01	Engineering Graphics and Design	1	-	4	3	30	70	3
5	18EE C01	Basic Electrical Engineering	3	1	-	3	30	70	4
	PRACTICALS								
6	18EE C02	Basic Electrical Engineering Lab	-	-	2	2	15	35	1
7	18CY C02	Chemistry Lab	-	-	3	3	25	50	1.5
		Total	**13**	**04**	**09**	**-**	**190**	**435**	**21.5**

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

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18MT CO3

MATHEMATICS– II

(Common to all Branches and except for Bio-Tech)

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

Course Objectives

1. To evaluate double and triple integrals of various functions and their significance.
2. To evaluate vector line, surface and volume integrals.
3. To know the relevant method to solve higher order differential equations.
4. To evaluate complex integration.
5. To evaluate real and definite integrals.
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. Find the areas, volumes and surface of solids revolution.
2. Use Greens, Gauss and Stoke's theorems to find the surface and volume integrals.
3. Able to solve solutions of differential equations with initial and boundary value problems.
4. Solve the problems on analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Real and complex integrals by using Cauchy's theorems.
6. Solve physical and engineering problems.

UNIT-I: Multivariable Calculus (Integration):

Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals, Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities).

UNIT-II: Vector Integral Calculus: Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem and Stoke's theorem (without proof).

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First Order Ordinary Differential Equations: Exact first order differential equations , Integrating factors, Linear first order equations , Bernoulli's, Riccati's and Clairaut's differential equations ,Orthogonal trajectories of a given family of curves.

UNIT-III:Ordinarydifferential equations of higher orders:
Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point and regular singular point, Power Series solution. Legendre Polynomial of first kind (without proof), Rodrigues formula, Generating function, recurrence relations, orthogonality of Legendre polynomials, Bessel's function of first kind (without proof), recurrence relations and problems.

UNIT-IV:Complex Variables –I :
Differentiation, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof).

UNIT-V: Complex Variables – II:
Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Laurent's series, zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine. Improper real integrals with singular points on the upper half plane.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced engineering mathematics Narosa Publications, 5th edition,2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

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18CY C01

CHEMISTRY

(Common to all Branches)

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

Course Objectives

1. 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.
2. This syllabus helps at providing the necessary introduction of the inorganic chemistry principles and concepts of chemical bonding involved in a comprehensive manner understandable to the students aspiring to become practicing engineers.
3. Thermodynamic and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems.
4. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
5. New materials lead to discovering of technologies in strategic areas like defense and space research for which an insight into nano and composite materials of modern chemistry is essential.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels.

The course will enable the student to:

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations & Ionic Equilibria.
3. List major chemical reactions that are used in the synthesis of molecules.

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4. Apply the various methods used in treatment of water for domestic and industrial use.
5. Discuss the various Engineering materials & Drug synthesis & their applications.

UNIT-I Atomic and molecular structure:

Molecular Orbital theory - atomic and molecular orbitals.Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Energy level diagrams of diatomics (H_2, He_2^+,N_2, O_2, O_2^-, CO, NO). Pi- molecular orbitals of butadiene , benzene and their aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

UNIT-II Use of free energy in chemical equilibria and Ionic Equilibria:

Use of free energy in chemical equilibria : Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy(criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials–electrochemical series. Nernst equation and its applications.Potentiometric Acid base & Redox Titrations.Numericals.

Ionic Equilibria: Solubility product, Determination of solubility product, Applications of solubility product- Determination of solubilities of sparingly soluble salts; Predicting precipitation reactions; Precipitation of an insoluble salt; Precipitation of soluble salts ; Inorganic analysis .Numericals.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures , Symmetry and chirality, Stereoisomers - Configurational isomers (Geometrical&Optical isomers), Conformational isomers - Newman and sawhorse representations of n-butane, enantiomers (lactic acid), diastereomers (Tartaric acid) , optical activity, absolute configurations , Sequence rules for R&S notation.

Organic reactions

Types of Organic reactions:

Substitution Reactions-Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution(S_N1& S_N2); Free Radical Substitution(Halogenation of Alkanes).

Addition Reactions:

Electrophilic Addition – Markonikoff's rule.

Nucleophilic Addition – (Addition of HCN to carbonyl compounds).

Free radical Addition - Anti Markonikoff's rule (Peroxide effect).

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Eliminations-E_1 and E_2 (dehydrohalogenation of alkyl halides).
Oxidation with $KMno_4$, $K_2Cr_2O_7$; **Reduction** with $LiAlH_4$,$NaBH_4$.
Cyclization (Diels - Alder reaction).

UNIT–IV 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 , Ozonisation & UV radiation.

UNIT-V Engineering Materials and Drugs:
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.
Conducting polymers- Definition, classification and applications.
Drugs-Introduction,Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

TEXT BOOKS

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Mali, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition(2011).
4. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C. Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READINGS

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

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18CE C01

ENGINEERING MECHANICS

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

Course Objectives:

1. The objective of this course is to understand the resolution of forces and to obtain resultant of all force systems, to understand moment of a force and equilibrium conditions of static loads for smooth and frictional surface.
2. To obtain centroid, centre of gravity and moment of inertia for various regular and composite areas and bodies.
3. To understand the basic structural analysis, principles of virtual work and energy methods.
4. To know the basic concepts of dynamics and analysis as a particle and rigid bodies.
5. To understand the work energy principles, impulse momentum and their applications and to know the concept of simple harmonic motion and free vibration.

Course Outcomes: The students will be able to

1. Solve problems dealing with forces in plane and space force systems, draw free body diagrams to analyze various problems in equilibrium, for smooth and frictional surface.
2. Determine centroid and moment of inertia for elementary, composite areas and bodies.
3. Analyze simple trusses for forces in various members of a truss.
4. Solve problem in kinematics and kinetics of particles and rigid bodies.
5. Analyze body motion using work energy principles, impulse and momentum approach and able to apply the concepts of simple harmonic motion and free vibrations in dynamics.

Unit–I: Resolution, Resultant and Equilibrium of force system and Friction: Concepts of force, System of forces, components of forces in a plane and in space systems. Resultant of force systems.Moment of forces and its applications.Couples and its applications.Equilibrium of Force systems. Free body diagrams, equation of equilibrium of coplanar and spatial force systems. Static indeterminacy. Types of friction, Laws of friction, application of friction to a single body & connecting systems, wedge friction.

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Unit–II: Centroid, centre of gravity and moment of Inertia:
Centroid of simple figures from first principle, centroid of composite sections. Centre of gravity and its implications, Definition of Area moment of Inertia, Moment of inertia of plane section from first principles, Theorems of moment of inertia, moment of inertia of standard sections and composite sections, Mass moment of inertia of rectangular and circular plates, cylinder, cone & sphere.

Unit–III: Analysis of simple trusses, Virtual work and Energy methods:
Analysis of simple trusses using method of joints, methods of sections. Determine if a member is in tension or compression, zero force members. Virtual displacements, Principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom.Conservative forces and potential energy, energy equation for equilibrium.

Unit–IV: Particle Dynamics:
Rectilinear and curvilinear translation using rectangular, normal and tangential components.Relative and constrained motion. Newton's 2nd Law, rectangular and path coordinates. Basic terms, general principles in dynamics, D' Alembert's principle and its application in plane motion and connected bodies.Instantaneous centre of rotation in plane motion and simple problems.

Unit–V: Work- Energy, Impulse-momentum and Mechanical Vibrations:
Equation of work energy for translation and fixed axis rotation, work energy principles applied to particle motion, connected systems. Introduction to linear impulse momentum, principle of conservation of linear momentum, Impact, direct and oblique. Introduction to vibration, free and forced vibrations, simple harmonic motion, simple pendulum and compound pendulum.

Text Books:

1. Reddy Vijaykumar K. and J. Suresh Kumar," Singer's Engineering Mechanics Statics and Dynamics", B. S. Publications 2011.
2. A. Nelson, "Engineering Mechanics", Tata McGraw Hill, New Delhi, 2010.

Suggested Reading:

1. Irving H. Shames, "Engineering Mechanics", 4th Edition, Prentice Hall, 2006.
2. F. P. Beer and E. R .Johnson, "Vector Mechanics for engineers, Vol. I - Statics, Vol. II - Dynamics",
   9th edition, Tata McGraw Hill, 2011.
3. R. C. Hibbeler, "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press, 2006.

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18ME C01

ENGINEERING GRAPHICS AND DESIGN

Instruction	1T+4D 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 prepare to design a system, component, or process to meet desired needs within realistic constraints
2. to prepare the student to communicate effectively.
3. to prepare the student to use the techniques, skills, and modern. engineering tools necessary for engineering practice.
4. to get exposure to a CAD package.

Course Outcomes:

1. Introduction to engineering design and its place in society.
2. Exposure to the visual aspects of engineering design.
3. To become familiar with engineering graphics standards.
4. Exposure to solid modelling.
5. Exposure to computer-aided geometric design.
6. Exposure to creating working drawings.
7. Exposure to engineering communication.

Detailed contents

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Coordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling; Introduction to Building Information Modeling (BIM).

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory).

UNIT-1 Introduction to Engineering Drawing:

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and
Involute;

UNIT-2 Orthographic Projections:

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes (without traces) ; Projections of planes inclined Planes;

Introduction to CAD package:

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

UNIT-3 Projections of Regular Solids:

Projection of Prism, Cylinder, Pyramid and Cone : Simple position, axis inclined to one of the reference plane only. Customization & CAD Drawing: consisting of set up of the drawing page and the printer, including scale
settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT-4 Sections and Sectional Views of Right Angular Solids:

Sections of solids in simple position Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.

Annotations, layering & other functions:

applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design

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(CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and twodimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling.

UNIT-5 Isometric Projections:
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Viceversa, Conventions.

Demonstration of a simple team design project:
Geometry and topology of engineered components: creation of engineering odels and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; (Examples of specific components to the branch of study may be included).

Text Books:

1. N.D.Bhatt, Elementary Engineering Drawing, Charotar Publishers,2012
2. K.L.Narayana and P.K.Kannaiah, –Text Book of Engineering. Drawing, Scitech Publications, 2011.
3. Basanth Agrawal and C M Agrawal –Engineering Drawing 2e –, McGraw-Hill Education(India) Pvt.Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., –Engineering drawing Pearson, 2ndedition, 2009.
2. K.Veenugopal, –Engineering Drawing and Graphics + Autocad, New Age International Pvt.Ltd,2011.
3. Bhattacharya. B, –Engineering Graphics I. K. International Pvt.Ltd, 2009.

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18EE C01

BASIC ELECTRICAL ENGINEERING

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

Course Objectives:

1. To understand the behavior of different circuit elements R,L & C, and the basic concepts of electrical circuit analysis.
2. To know the concepts of AC circuits, RMS value, Average value, Phasor analysis etc.
3. To understand the basic principle of operation of Transformer and DC machines.
4. To understand the basic principle of operation of DC machines and AC machines.
5. To know about different types of electrical wires and cables, domestic and industrial wiring.
6. To understand safety rules and methods of earthing.

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

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

UNIT-I: DC Circuits

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

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UNIT-II: AC Circuits

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

UNIT-III: Transformers

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

UNIT-IV: DC and AC Machines

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

UNIT-V: Electrical Installations

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

Text books:

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

Suggested Reading:

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

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18EE C02

BASIC ELECTRICAL ENGINEERING LAB

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

Course Objectives:

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

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

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the circuit analysis techniques.
4. Determine the parameters of the given coil.
5. Understand the basic characteristics of transformer.
6. Understand the basic characteristics of dc and ac machines.

List of Laboratory Experiments/Demonstrations:

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

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

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18CY C02

CHEMISTRY LAB

(Common to all branches)

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

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. The student should be conversant with the principles of volumetric analysis and identification of organic functional groups.
3. To apply various instrumental methods to analyze the chemical compounds and to improve understanding of theoretical concepts.

Course Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

Thestudents will learn to:

1. Estimate rate constants of reactions from concentration of reactants/ products as a function of time.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
3. Synthesize a small drug molecule and Identify the organic compounds.
4. understand importance of analytical instrumentation for different chemical analysis.
5. Perform interdisciplinary research such that the findings benefit the common man.

Chemistry Lab

1. Estimation of temporary and permanent hardness of water using EDTA solution
2. Estimation of amount of chloride in water.
3. Determination of rate constant for the reaction of hydrolysis of methyl acetate.(first order)
4. Estimation of amount of HCl Conductometerically using NaOH solution.
5. Estimation of (a) amount of CH_3 COOH Conductometerically using NaOH solution. (b) amount of HCl and CH_3 COOH present in the given mixture of acids Conductometerically using NaOH solution.

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6. Estimation of amount of HCl Potentiometrically using NaOH solution.
7. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution.
8. Distribution of acetic acid between n-butanol and water.
9. Synthesis of drug - Aspirin.
10. Organic Chemistry- Identification of Functional groups - neutral group (carbonyl groups-acetaldehyde and acetone); acidic group (benzoic acid); basic group (aniline)
11. Determination of surface tension of organic solvents (ethanol, ethyl acetate)
12. Determination of Viscosity.

TEXT BOOKS

1. J. Mendham and Thomas ,"Vogel' s text book of quantitative chemical analysis",Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.

SUGGESTED READINGS

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

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Choice Based Credit System (CBCS)
Name of the Programme (UG): B.E

Syllabus for III - Semester and IV - Semester

With effect from 2017 - 2018

Specialization /Branch:
Electrical & Electronics Engineering

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

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
Choice Based Credit System

B.E (Electrical and Electronics 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	16EE C02	Electrical Circuits-I	3	-	3	30	70	3
3	16EE C03	Electrical Measurements and Instruments	3	-	3	30	70	3
4	16EC C16	Electronics Engineering	4	-	3	30	70	4
5	16ME C11	Prime Movers and Pumps	3	-	3	30	70	3
6	16MB C01	Engineering Economics and Accountancy	3	-	3	30	70	3
PRACTICALS								
6	16EE C04	Circuits and Measurements Lab	0/1	2	3	25	50	2
7	16EC C17	Electronics Engineering Lab	-	3	3	25	50	2
8	16ME C12	Prime Movers and Pumps Lab	0/1	2	3	35	50	2
Total			**21**	**7**	**-**	**255**	**570**	**25**

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

CIE - Continuous Internal Evaluation SEE - Semester End Examination

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 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%.

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.

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: $\int^{\infty} f(x)dx$ Where f(x) has no poles on real axis and.

Text Books:

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

Suggested Reading:

1. N P Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi publishers, 9th Edition, 2016.
2. Alan Jeffrey, Mathematics for Engineers and Scientists, Chapman & Hall/CRC publishers, 6th Edition, 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, Narosa Publications, 3rd Edition,2007.

16EE C02

ELECTRICAL CIRCUITS – 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 the nature of different circuit elements, fundamental circuit laws and network theorems.
2. To be acquainted with electrical circuit analysis, which is the foundation for all subjects of the Electrical Engineering discipline.
3. To Study transient response of circuits with initial conditions & forcing functions and also basics of network topology.
4. To understand poly-phase circuits and measurement of three phase power.

Course Outcomes: The student will be able to

1. Acquire concepts of the nature of different circuit elements, network theorems and electrical circuit analysis.
2. Analyze R-L-C circuits under steady state condition.
3. Analyze the behavior of circuits under transient conditions.
4. Analyze balanced and unbalanced 3-phase AC circuits.
5. Acquire the knowledge of resonance, coupled circuits and network topology.
6. Acquire knowledge to apply the Electrical Circuits concepts to Electrical Engineering.

UNIT –I

Circuit Analysis: Loop, mesh, supermesh analysis, node, supernode analysis with DC and AC excitations.

UNIT – II

Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, Reciprocity, Milliman's and Tellegen's Theorems.

UNIT – III

Resonance: Definitions and computations of series and parallel resonance, Bandwidth and Q-factor; Locus diagrams; Coupled circuits, Analysis of circuits with mutual inductance, Linear and ideal transformers.

Network Topology: Network Graph concept, Oriented graph, Node, Branch, Complete incidence matrix, Tree and its properties, Cotree, Tie-set, Fundamental tie-set matrix, Cut-set, Fundamental cut-set matrix; Duality.

UNIT – IV

Transient Response: Initial Conditions in zero-input response of RC, RL and RLC networks, Definitions of Unit Impulse, Unit Step and Ramp functions; Zero state response with Impulse and Step inputs; Complete response of circuits with initial conditions and forcing functions such as Step and Sinusoidal functions.

UNIT – V

Poly Phase Circuits: 3-phase circuit analysis, Star and delta connected systems, Calculations of voltage, current and power in 3-phase circuits with star and delta connected loads and generator, Balanced and unbalanced loads. Measurements of 3-phase power by two wattmeter method.

Text Books:

1. M. E. Van Valkenburg, Network Analysis, Prentice Hall of India Publications, 3^{rd} Edition, 1995.
2. W. H. Hayt, J .E. Kemmerly, Engineering Circuit Analysis, McGraw Hill Publications, 8^{th} Edition, 2013.
3. Charles K. Alexander & Matthew N. O. Sadiku, Fundamentals of Electric Circuits, TMH Publications, 5^{th} Edition, 2013.

Suggested Reading:

1. A. Sudhakar & Shyammohan Palli, Network Analysis, Tata McGraw-Hill Publications, 4^{th} Edition, 2010.
2. N.C. Jagan & C. Lakshminarayana, Network Analysis, B. S. Publications, 3^{rd} Edition, 2014.
3. Roy Chowdary, Networks & Systems, Newage Publications, 2^{nd} Edition, 2010.
4. M Nahvi, Joseph Edminister, K. Uma rao, Electric Circuits, Schaum's Outline Series, Tata Mc-Graw Hill Publications, 5^{th} Edition, 2010.

16EE C03

ELECTRICAL MEASUREMENTS AND INSTRUMENTS

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

Course Objectives:

1. To understand the principle behind various instruments.
2. To comprehend the torque equations of instruments.
3. To know the various bridges for measurement of R, L and C.
4. To calibrate the instruments.

Course Outcomes: The student will be able to

1. Identify a suitable instrument to measure a given parameter.
2. Analyze the need of CT/PT for a given system.
3. Illustrate the concept of the instrument with relevant examples and proper justification.
4. Distinguish between electrical and magnetic measurements and their instruments.
5. Recognize the appropriate bridge method of measurement for a given parameter.
6. Specify the right digital instrument for a given requirement.

UNIT- I

Introduction to Measurements: Objectives of measurement, static and dynamic characteristics, errors and their classification.

Introduction to Instruments-1: Types of instruments, classification of instruments based on type of measurement and principle of working (PMMC, MI, Dynamometer, Induction and Electrostatic), types of torques (torque equations for MC, MI and dynamometer type instruments).

UNIT- II

Introduction to Instruments-2: Single phase Induction type energy meter, Driving torque & Braking torque equations, errors and their compensation, Single phase Dynamometer type Power factor meter, Weston type frequency meter. Construction & theory of Instrument Transformers, Equations for ratio and phase angle error of C.T & P.T (Elementary treatment only).

UNIT- III

Resistance, Inductance and Capacitance parameters: Classification of resistance measuring methods Kelvin's double bridge, Wheatstone bridge and meggar. Measurement of inductance using Maxwell's inductance bridge, Maxwell's Inductance - Capacitance Bridge and Anderson's bridge. Measurement of capacitance using De-Sauty's bridge and Schering bridge. Derivation of bridge balance conditions, merits and demerits, applications and related numerical problems.

UNIT- IV

Measurements of Magnetic and Electric Parameters: Ballistic galvanometer- Principle of operation, construction and applications of Ballistic galvanometer, flux meter its construction and principle of operation. Determination of B-H curve using method of reversals, Epstein square bridge for measuring Iron losses. Potentiometers, Classification - Crompton DC&AC polar type, Applications. Calibration of ammeter, voltmeter & wattmeter.

UNIT-V

Introduction to Digital Instruments (DVM and Transducers): Introduction to digital Instruments, Digital Voltmeters (DVM), Speed reading, Range selection, Over ranging, Common mode rejection, Digital Multi meters, bidirectional meters.

Transducers: Objectives, Introduction, Role of Transducers in measurement system, Guidelines for selecting & using transducers. Strain Gauge, Linear variable Differential transformer (LVDT), Temperature transducers, bimetallic strip, Thermocouples, Resistance Temperature Detectors (RTD), Thermostats, Radiation pyrometers.

Text Books:

1. F.W.Golding and Widdis, Electrical Measurements and measuring Instruments, A.H.Wheeler & Co., 5th Edition, 2007.
2. A.K.Sawhney, A Course in Electrical and Electronics Measurements and Instrumentation, Dhanapat Rai & Sons, NewDelhi, 19th Edition, 2011.
3. CT. Baldwin, Fundamentals of Electrical measurements, Kalyani publications, 2001.

Suggested Reading:

1. Helfrick, Albert D., Cooper, William D., Modern Electronic Instrumentation and Measurement Techniques, PHI Publications, 1990.
2. Stanley Wold, Richard F.M.Smith, Student reference manual for Electronic Instrumentation Laboratories, 2nd Edition, PHI.
3. Alan. S. Morris, Essence of Measurement, PHI, 1996.

16EC C16

ELECTRONIC 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:
Student will be able to understand:
1. The various diodes and transistors.
2. The design and analysis of various rectifiers with filters.
3. The behavioral characteristics of BJT in various configurations.
4. The design and analysis of amplifiers.
5. The behavioral characteristics of JFET and MOSFET.
6. The effect of negative feedback amplifiers and its performance.

Course Outcomes: Student will be able
1. To understand semiconductor devices such as PN junction Diodes, BJT, JFET and MOSFET.
2. To analyze application of diodes.
3. To study V-I characteristics BJT, JFET and MOSFET.
4. To study the switching behavior of BJT, JFET, MOSFET.
5. To study the equivalent model of PN junction diode, BJT, JFET and MOSFET.
6. To analyze transistor amplifier with and without feedback in various configurations - BJT, JFET.

UNIT - I

Diode and its Applications: The p-n junction formation, Diode current components, The Volt-ampere characteristic of p-n diode, Diode as a circuit element, small signal diode models, Breakdown mechanisms of diode - Zener and Avalanche, Zener voltage regulator. Half wave, Full wave and Bridge Rectifiers with and without filters, their operation, performance characteristics.

UNIT - II

BJT Characteristics: The junction transistor, operation of NPN and PNP transistor, current components and current flow in BJT, Modes of transistor operation, Early effect, BJT input and output characteristics - CB, CE CC configuration, h-parameters, BJT as a Switch; BJT biasing techniques, stability factors, Bias compensation techniques, Thermal runway, Thermal stability.

UNIT - III

BJT Amplifiers: BJT as an amplifier, Equivalent model of BJT, Single Stage Amplifiers (CB,CE,CC), exact and approximate analysis, Frequency response, Bandwidth and Multi Stage Amplifiers (CE-CE, CE-CB & CC-CC),Power Amplifiers-Class A, Class B, Efficiency, power dissipation.

UNIT - IV

Field Effect Transistors: The Junction Field Effect Transistor operation, The Pinch-off Voltage VP, V-I characteristics of JFET. JFET biasing-zero current drift biasing, FET as a switch. FET amplifiers(CS,CD,CG Amplifiers) MOSFETs: types of MOSFETs, V-I characteristics.

UNIT - V

Feedback 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.

Text Books:

1. Jacob Millman, Christos C. Halkias, Integrated electronics: analog and digital circuits and systems, 2^{nd} Ed, McGraw-Hill, 2010.
2. Robert L. Boylestad, Louis Nashelsky Electronic Devices and Circuit Theory, 10^{th} Edition, PHI, 2009.

Suggested Reading:

1. David Bell, Fundamentals of Electronic Devices and Circuits, 5^{th} Edition, Oxford University Press 2008.
2. Ben G Streetman and Sanjay Banerjee, Solid State Electronic Devices, 6^{th} Edition, Pearson Education, 2005.
3. Millman and Halkias, Electronic devices and circuits, 2^{nd} Edition, McGraw Hill Publication, 2007.

16ME C11

PRIME MOVERS AND PUMPS

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

Course Objectives: Student will understand

1. Various equations related to energy head and loss of head due to friction.
2. Working principles of hydraulic turbines.
3. Working principle of various types of boilers.
4. Working principle of various types of steam turbines and gas turbines.
5. Working principle of reciprocating pumps.
6. Working principle of centrifugal pumps.

Course Outcomes: Students will be able to

1. Estimate the loss of head due to friction.
2. Determine power developed by different types of the hydraulic turbines.
3. Differentiate fire tube boilers from water tube boilers.
4. Estimate power developed by different types of the steam turbines and gas turbines.
5. Evaluate the power required by reciprocating pumps.
6. Determine the power required by centrifugal pumps.

UNIT- I

Fluid Mechanics: Newtonian and Non-Newtonian Fluids, viscosity, types of fluid flows, Bernoulli's equation and its applications, laminar and turbulent flows, flow through pipes, friction losses in pipes, Darcy equation, Reynolds number and its significance.

UNIT- II

Hydraulic Turbines: Classification and working principles of turbines - Pelton, Francis and Kaplan turbines, velocity diagrams for impulse and reaction turbine, calculation of blade angles, work-done, power output and efficiencies, specific speed of turbines. unit testing and model testing of turbines.

UNIT- III

Generation of Steam: Dryness fraction and properties of steam, function of boilers, working principle of Lancashire boiler, Locomotive boiler, Babcock and Wilcox boiler, boiler mounting and accessories.

UNIT- IV

Steam Turbines: Classification of steam turbines, velocity diagrams for simple impulse and reaction turbines, compounding of steam turbines, pressure compounding, velocity compounding, and pressure-velocity compounding, problems on work done, blade angles, power and thermal efficiency of the turbine. Gas turbine: Thermal efficiency of Joule cycle and simple problems.

UNIT-V

Pumps: Reciprocating pumps, working of single and double acting types, effect of acceleration head and friction, use of air vessels, work done and power required without and with air vessels, minimum speed to avoid cavitation Centrifugal pumps: Classification and working of centrifugal pumps, need for priming, workdone and efficiencies, pressure rise, minimum starting speed, specific speed and model testing of pumps, cavitation and its effect on performance.

Text Books:

1. R.K.Rajput, Thermal Engineering, Laxmi Publications Pvt. Ltd, 8th Edition, 2011.
2. P.L. Ballaney, Thermal Engineering , Khanna Publications., 20th Edition, 2004.
3. P.N.Modi & S.M.Seth, Hydraulics and Fluid Mechanics including Hydraulic machines, Standard Book House, 18th Edition, 2011.

Suggested Reading:

1. Mahesh M Rathor, Thermal Engineering, Tata Mc.Graw-Hill Publishers 2013.
2. D.S.Kumar,Thermal Science and Engineering ,S.K.Kataria & Sons, 2009.
3. Jagdish Lal, Hydraulics & Fluid Mechanics, Metropolitan Book Co. Pvt. Ltd., 2004.

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 : 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 Reading:

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.

16EE C04

CIRCUITS AND MEASUREMENTS LAB

Instruction	1T+2P 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 thoroughly the fundamental concepts of all theorems.
2. To comprehend the basic principles of operation of measuring various circuit parameters.
3. To become familiar with digital instruments.

Course Outcomes: The student will be able to:

1. Specify the suitable technique to be adopted for the analysis of the given circuit.
2. Distinguish the adaptability of different techniques to prove theorems experimentally.
3. Analyze the transient response of a given circuit.
4. Know the right instruments (digital / analog) and its usage for a given circuit parameter.
5. Select a suitable bridge technique available for a given fundamental parameter measurement.
6. Identify the circuit parameters for a given locus diagram.

LIST OF EXPERIMENTS

PART - A: CIRCUITS

1. Transient response of first and second order circuits.
2. Frequency response of a RLC series circuit and Locus diagrams.
3. Determination of two port network parameters. (Z, Y, h & ABCD)
4. Verification of Thevenin's& Norton's Theorems.
5. Verification of Superposition, Reciprocity and Maximum power transfer theorems.
6. Determination of parameters of a coil.

PART - B: MEASUREMENTS

1. Measurement of resistance and Capacitance.
   i) Kelvin's double bridge
   ii) Schering bridge .
2. Calibration of Energy Meter
   i) Single-phase meter with Phantom loading
   ii) Three-phase meter with direct loading.

3. Measurement of inductance.
   i) Maxwell's
   ii) Anderson's bridges.
4. Measurement of voltage and impedance using DC potentiometer
5. Measurement of
   i) Iron losses using Epstein's square bridge
   ii) Frequency using Lissajous pattern.
6. Study of Digital instruments.

Note: At least **FIVE** experiments should be conducted from each **PART**.

16EC C17

ELECTRONIC ENGINEERING 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: Student will be able to understand:

1. The V-I Characteristics of diodes.
2. The design of various rectifiers.
3. The Transistor Characteristics and measurement of h-parameters.
4. The frequency response of BJT and FET amplifiers.
5. The study of various feedback amplifiers.
6. The performance analysis of multistage amplifiers.

Course Outcomes: Student will be able to

1. Verify the working of PN junction diodes, transistors and their characteristic behavior.
2. Design various rectifiers with different filter combinations.
3. Set up bias point in a transistor.
4. Build an amplifier and find the frequency response of amplifier.
5. Build a feedback amplifier and find the frequency response of amplifier.
6. Build a multi stage amplifier and find the frequency response of amplifier.

LIST OF EXPERIMENTS

PART-A

1. V-I characteristics of (Silicon and Germanium) diodes and measurement ofstatic and dynamic resistance.
2. Zener diode characteristics and its application as an voltage regulator.
3. Design, realization and performance evaluation of rectifier circuits with andwithout filters(C & -section)Half wave rectifier.
4. Design, realization and performance evaluation of rectifier circuits with and r without filters(C & -section) Full wave rectifier.
5. Plotting the characteristics of BJT and measurement of h-parameters.
   a) Common Base Configuration b) Common Emitter Configuration
6. Plotting the characteristics of JFET in Common Source Configuration and measurement of trans- conductance and drain resistance.
7. Design of Biasing circuits.
   a) BJT b) JFET

PART-B

1. Design and Frequency response of Common Emitter BJT amplifier and measurement of Gain, Bandwidth, Input and Output impedances.
2. Design and Frequency response of Common Source FET amplifier and measurement of Gain, Bandwidth and Output impedance.
3. Design and Frequency response of Single stage and Multi stage RC coupled amplifier using BJT.
4. Design and Frequency response of Single stage and Multi stage RC coupled amplifier using FET.
5. Feedback amplifier frequency response of
   a) Voltage Series
   b) Voltage Shunt
6. Frequency response of Current series feedback amplifier.
7. Class B Power Amplifier.

NOTE: At least **SIX** experiments should be conducted from each part.

16ME C12

PRIME MOVERS AND PUMPS LAB

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

Course Objectives: Student will understand

1. Application of the equation in measuring discharge of fluid.
2. The verification of energy head at various points in the stream.
3. The application of Darcy equation for flow through pipes.
4. Working principles of Pelton, Francis and Kaplan turbines.
5. Working principles of various types of pumps.
6. The working principle of internal combustion engines.

Course Outcomes: Student will be able to

1. Determine the principle of measurement of discharge of fluid.
2. Determine the direction of flow of fluid in the pipe.
3. Determine loss of head due to friction.
4. Estimate the power developed by Pelton, Francis and Kaplan turbines.
5. Determine the power required by various types of pumps.
6. Evaluate the performance of internal combustion engines.

LIST OF EXPERIMENTS

1. Measurement of discharge by venturimeter.
2. Verification of Bernoulli's equation.
3. Major (friction) losses in pipes - Laminar and Turbulent flows.
4. Performance of Pelton turbine.
5. Performance of Francis turbine.
6. Performance of Kaplan turbine.
7. Performance characteristics of reciprocating pump.
8. Performance characteristics of centrifugal pump.
9. Performance characteristics of Self priming pump.
10. Performance characteristics of Gear pump.
11. Performance test on Single cylinder diesel engine.
12. Heat balance test on single cylinder diesel engine.
13. Performance test on multi cylinder petrol engine.

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

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

SEMESTER - IV

S.No.	Course Code	Title of the Course	Scheme of Instruction: Hours per week		Scheme of Examination			Credits
			L/T	P/D	Duration of SEE in Hours	Maximum Marks: CIE	SEE	
THEORY								
1	16EEC06	Electrical Circuits -II	3	-	3	30	70	3
2	16EE C07	Electrical Machinery - I	3	-	3	30	70	3
3	16EE C08	Power Systems - I	3	-	3	30	70	3
4	16EE C09	Electromagnetic Theory	3/1	-	3	30	70	4
5	16EE C10	Digital Elctronics and Logic Design	3	-	3	30	70	3
6	16EE C11	Linear Integrated Circuits	3	-	3	30	70	3
PRACTICALS								
6	16EE C12	Electrical Machinery - I Lab	0/1	2	3	25	50	2
7	16EE C13	Linear Integrated Circuits Lab	0/1	2	3	25	50	2
8	16EG C03	Soft Skills and Employability Enhancement Lab	-	2	2	15	35	1
		Total	**21**	**6**	**-**	**245**	**555**	**24**

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

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 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%.

16EE C06

ELECTRICAL CIRCUITS - 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:

1. To understand the application of Laplace Transforms for analysis of Electrical Circuits.
2. To comprehend the application of Fourier series and Fourier transform representation of periodic signals.
3. To study the analysis of two port networks.
4. To study the aspects of network synthesis.

Course Outcomes: The student will be able to

1. Apply Laplace transform for circuit analysis and also able to draw the pole zero plots.
2. Find network functions and two port parameters and transform.
3. Acquire the knowledge to find the Fourier series of given function.
4. Acquire the knowledge synthesize the RL and RC circuits.
5. Design of the different types of filters.
6. Acquire knowledge to design of filters in mitigating harmonics.

UNIT- I

Circuit Analysis in S-Domain: Review of Laplace Transform, Initial and final value theorems, Application of Laplace transform for circuit analysis, Concept of transfer function, Pole, Zero plots.

UNIT-II

Two port Networks: Z, Y, ABCD and h-parameters, their interrelationships; series, parallel and cascade connection of two port networks, image & iterative impedances, terminated two port networks.

UNIT- III

Fourier Series: Representation of periodic functions using both trigonometric and exponential functions; Symmetry conditions, Fourier transform representation of a periodic signals, Symmetry properties; Power and bandwidth concepts; System function and its application in determining steady- state response.

UNIT-IV

Network Synthesis: Hurwitz polynomials and their properties, Positive Real functions and their properties, Synthesis of reactive network (one port) by Foster method, pole-zero interpretations of elements of Foster form, Cauer form of reactive networks, RL network synthesis by Foster and Cauer form of representation, RC network synthesis by Foster and Cauer method.

UNIT-V

Passive Filters: Classification and General Relations in filters, Constant-K low pass, high pass, band pass and band elimination filters; M-derived low pass, high pass, band pass and band elimination filters.

Text Books:

1. M.E. Van Valkenburg, Network Analysis, Prentice Hall of India Publications, 3rd Edition, 1995.
2. W.H.Hayt, J.E.Kimmerly, Engineering Circuit Analysis, McGraw Hill, 8th Edition, 2013.
3. Gopal. G. Bhise, Prem Chadha and Kulashetra, Network Analysis and Filter Design, Umesh Publications, 2000.
4. M Nahvi, Joseph Edminister and K Uma Rao, Electric Circuits, Schaum's Outline Series, Tata Mc-Graw Hill Publications, 5th Edition, 2010.

Suggested Reading:

1. Franklin F. Kuo, Network Analysis And Synthesis, Wiley Publications, 2nd Edition 2009.
2. A. Sudhakar, Shyammohan Palli, Network Analysis, Tata Mc-Graw Hill Publications, 4th Edition, 2010.
3. T.K. Nagsarkar, Sukhija, Circuits & Networks, Oxford University Press, 2nd Edition, 2010.

16EE C07

ELECTRICAL MACHINERY- 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 study the principles of electro mechanical energy conversion.
2. To understand Armature reaction and commutation in DC machines. To understand types of DC generators and motors, and their characteristics and applications.
3. To discuss different methods of speed control of DC motors and Testing of DC Machines.
4. To familiarize the construction details, principle of operation, prediction of performance, methods of single-phase transformers.
5. To know different connections of 3-phase transformers and parallel operation.

Course Outcomes: The student will be able to

1. Apply basic principles of electromechanical laws and energy conversion.
2. Acquire knowledge about operating characteristics of generators, speed control of DC motors and their application in Industry and domestic appliances.
3. Acquire the concept of single phase and three phase transformers and their applications.
4. Distinguish between different types of 3-phase transformers connection.
5. Analyze the performance of single- phase and 3-phase transformers during parallel operations.
6. Understand a 3-phase to 2-phase conversion system through Scott connection.

UNIT- I

Principles of Electro-Mechanical Energy Conversion: Energy in magnetic system, Field energy and mechanical force, Direction of mechanical force developed, Flow of energy in electro-mechanical devices, singly excited and multiply excited systems, Basic concepts of magnetically induced emf and force.

UNIT -II

DC Machines: Brief description of constructional features, Armature windings, simple lap and wave windings, Brush position, Classification of DC Machines.

DC Generators: Generated emf, Methods of excitation, Armature reaction, Theory of commutation, Types of generators and their characteristics, Series and parallel operation.

UNIT-III

DC Motors: Generation of electromagnetic torque, Types of motors and their characteristics, Application of motors, Starting and speed control methods of DC motors. Testing of DC Motors, Losses and efficiency, Swinburne's test, Hopkinson's test, Field test for series motors, Retardation test, Separation of losses.

UNIT-IV

Single Phase Transformers: Constructional features, Principle of operation, Ideal transformer, Transformer on 'No load' and 'On load', Vector diagram, Equivalent circuit, Polarity test, O.C & S.C tests, Sumpner's test, Regulation & efficiency, All day efficiency, Separation of losses- Excitation Phenomena of Transformers.

UNIT-V

Three Phase Transformers: Three phase transformers connections Y-Y, and Scott connections. Parallel operation of transformers.

Text Books:

1. Nagrath I.J & Kothari D.P, Electrical Machines, Tata McGraw Hill Publications, Sigma series, 2006.
2. H.Cotton, Advanced Electrical Technology, Wheeler & Co, CBS publishers, 7th Edition, 2005.
3. J.B Gupta, Theory and performance of electrical machines, S.K. Kataria & Sons, 14th Edition, 2014.

Suggested Reading:

1. P.S. Bhimbra, Electrical Machinery, Khanna Publications, 7th Edition, 2003.
2. Fitzgerald Kingsley, Umans, Electric Machinery, Tata Mc-Graw Hill Publications, 6th Edition, 2002.
3. Ashfaq Husain, Electrical Machines, Danpatrai and sons publications, 2nd Edition, 2012.

16EE C08

POWER SYSTEMS - I

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

Course Objectives:

1. To introduce Generation of energy through conventional sources such as: Thermal, Hydro and Nuclear, also gives insight into the generation of power through non-conventional sources along with economic aspects.
2. To familiarize mechanical design of transmission lines and cables.
3. To familiarize present practices in tariff calculations.
4. To develop knowledge to understand classification and connection schemes of distribution systems.

Course Outcomes: The student will be able to

1. Gain knowledge of construction and operation of conventional and non-conventional sources of energy along with financial management.
2. Know the effects sag on transmission lines.
3. Acquire the concepts to study the performance of insulators and cables.
4. Gain knowledge in calculating the current practices in tariff.
5. Gain the knowledge to classify the connection schemes of distribution systems.
6. Acquire knowledge in different constructional aspects of over-head lines, underground cables and also economic aspects of Power generation.

UNIT-I

Thermal- Hydro -Power Plants: Principles, Choice of site, layout and various parts of generating stations, Brief description of Hydro Power Plant Dam, Spillways, Head works, Surge tank, Penstocks, Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses, Brief description of TPS components: Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and Cooling towers.

UNIT-II

Nuclear Station: Schematic Arrangement of Nuclear Power Station, Advantages and disadvantages, Types of Nuclear reactors, Gas Turbine Power Plant, Schematic arrangement of Gas Turbine power plant, Advantages and disadvantages. Introduction to Non-Conventional Energy Sources: Solar Energy, Radiation on earth surface - Introduction to Solar PV Technology, Wind Energy, Motion of Wind, Wind Power, Wind turbine siting, Major Applications. Tidal energy, limitations, tidal energy technology.

UNIT-III

Construction of Overhead lines: Overhead line materials, supports, types, Vibration dampers, Arcing horns, Ground wires, Sag /Tension calculations, Equal / Unequal supports, Effects of wind, ice / Erection Conditions Stringing charts. Insulators, Types, Material for construction, potential distribution over string of insulators, equalizing of potential, Methods, Insulator testing.

UNIT-IV

Underground Cables: Construction of Cables, Insulating Materials for Cables, Classification of Cables, Cables for 3-Phase Service, Laying of Underground Cables, Insulation Resistance of a Single-Core Cable, Capacitance of a Single-Core Cable, Dielectric Stress in a Single-Core Cable, Most Economical Conductor Size in a Cable, Grading of Cables ,Capacitance Grading, Inters heath Grading, Capacitance of 3-Core Cables, Measurements of Ce and Cc.

UNIT-V

Economics of Power Generation: Load curve, Load demand and diversified factors, Base load operation, Types of costs and depreciation calculations; Tariffs, different types of tariffs; Methods of power factor improvement.

General Aspects of AC and DC Distribution Systems-Types of D.C. & A.C Distributors, Calculations for Distributor fed at one end, distributor fed at both ends.

Text Books

1. C.L. Wadhwa, Electrical Power Systems, Wiley Eastern Ltd,5th Edition, 2009.
2. M.L. Soni, P.V.Gupta, V.S. Bhatnagar and A. Chakrabarti,A Text Book on Power System Engineering Dhanpat Rai& Co. Pvt. Ltd, 4th Edition, 2008.

Suggested Reading

1. M.V. Deshpande,Elements of Power Station Design, Eastern Economy Edition, 2010.
2. P.P. Walsh, P.Fletcher, Gas turbine performance, Blackwell Publisher, 2nd Edition, 2004.
3. S.N.Singh, Electric Power Generation, Transmission and Distribution, PHI Ltd., 2nd Edition, 2011.
4. B.H. Khan, Non-Conventional Energy Resources, Tata McGraw Hill, 2nd Edition, 2013.

16EE C09

ELECTROMAGNETIC 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 various coordinate systems and applications of vector calculus.
2. To comprehend the electrostatic field concepts and applications.
3. To assimilate the concepts and applications of magnetic fields.
4. To know the significance of EMI & EMC.

Course Outcomes: The student will be able to

1. Recognize the importance of different coordinate systems and vector algebra in field theory.
2. Analyze electric and magnetic field intensity, flux density and potential due to various charge distributions.
3. Differentiate between conduction & convection currents through various materials.
4. Apply Maxwell's equations for EM wave propagation.
5. Identify EMI & EMC, the causes and effects, various control methods of EMI.
6. Acquire knowledge in applying Electro Magnetic theory in design of electrical machines.

UNIT- I

Orthogonal Coordinate Systems &Review of Vector Calculus: Rectangular, Cylindrical, Spherical coordinate systems; Line, Surface and Volume integrals; Operator Del, Gradient, Divergence, Curl &Laplacian of a field; Divergence, Stokes' theorems.

Electrostatic fields: Various charge configurations, Coulomb's law, Electric field intensity and flux density of different charge distributions, Gauss law, Integral and Point form of Maxwell's Electrostatic Equation.

UNIT- II

Electrostatic Field in Materials: Electrical Potential, Capacitance of Parallel plate capacitor, Equi-potential lines, Properties of materials, convection and conduction currents, conductors, dielectric constant, continuity equation and relaxation time, boundary conditions, Poisson's and Laplace's equations, Uniqueness theorem.

UNIT-III

Magneto Static Fields: Biot-Savart's law, Ampere's law, Displacement current, Magnetic scalar and Vector Potentials, boundary conditions, Forces in Magnetic fields, Lorentz force equation, Force between parallel conductors, Inductance Calculations (Solenoid, Toroid), Mutual Inductance.

UNIT- IV

Time Varying Electromagnetic Fields: Faraday's laws of electromagnetic induction, Final forms of Maxwell's Equations, Power and Poynting theorem, Time-Harmonic Electromagnetic fields, Wave equations (One dimension), Plane Wave, Propagation in perfect and lossy-dielectrics.

UNIT-V

Electromagnetic Interference and Compatibility (Theoretical Aspects only): Introduction to Electromagnetic Interference and Electromagnetic Compatibility (EMI & EMC)- Sources and Characteristics of EMI, Control Techniques of EMI, Grounding, Shielding, Filtering. Introduction to numerical electro magnetics.

Text Books:

1. Hayt, W.H and J.A Buck, Engineering Electromagnetics, Tata Mc-Graw Hill, 7th Edition, 2006.
2. Sadiku, M.N.O, Principles of Electromagnetics, Oxford University press, 4th Edition, 2006.

Suggested Reading:

1. S. P. Seth, Elements of Electromagnetic Fields, Danpat Rai& Co, 2007.
2. David K. Cheng, Field and Wave Electromagnetics, Pearson Education. 2nd Edition 2004.
3. AshutoshPramanik, Electromagnetism Theory and Applications, PHI Pvt. Ltd., 3rd Edition, 2008.

16EE C10

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 understand the basics of Boolean algebra and Minimization Techniques.
2. To know the basics of Digital logic family.
3. To study binary arithmetic & its circuits and code converters.
4. To understand the Design of synchronous sequential circuits.
5. To know design of sequence detector and generators and programmable logic circuits.

Course Outcomes: The student will be able to

1. Apply Boolean algebra rules, K-maps, Tabulation methods to minimize Boolean algebraic expressions.
2. Classify, describe and compare the characteristics of various digital logic families.
3. Acquire the knowledge to build the combinational logic circuits.
4. Acquire the knowledge to build the sequential logic circuits.
5. Design the counters.
6. Acquire the knowledge to synthesize the digital circuits using D, JK & T Flip-flops.

UNIT- I

Number Systems: Introduction to number systems and their codes, Number complements: One's &Two's complement arithmetic, BCD and Excess-3 arithmetic.

Boolean Algebra: Review of Basics and laws of Boolean algebra, Minimization of Boolean expressions, Truth tables and maps, Sum of products and product of sums.

UNIT-II

Simplification of Boolean Functions: K-Map method of reduction, Incompletely specified functions, multiple output minimization, Tabular minimization.

Digital logic families and IC's: Characteristics of Digital IC's, Introduction to RTL, DTL, TTL, CMOS, ECL families, Comparison of performance.

UNIT-III

Binary Arithmetic and Circuits: Half and Full adder, Subtractor and Magnitude comparator, Carry look ahead adder.

Combinational Circuits: Multiplexer and de-multiplexer, Encoder and decoder, Code converters, Implementation of combinational logic using standard logic gates and multiplexers.

UNIT- IV

Sequential Logic: Basic latch circuit - Debouncing switch, Flip-flops: SR, JK, D and T, Truth table and excitation tables.

Registers & Counters: Registers, Shift registers, Applications of registers, Ripple & Synchronous counters- up/down counter, BCD counter, Counter decoding,, Ring counters.

UNIT-V

Design of Digital Systems: Concept of state, State diagram, Design of counters, Sequence detector and generators, Synthesis using D, JK, T flip-flops, Programmable Logic devices: Introduction, PROM, PLA, PAL.

Text Books:

1. Morris Mano M., Digital Design, Prentice Hall of India, 3rd Edition, 2002.
2. Donald Pleach, Albert Paul Malvino, Goutamsaba Digital Principles and Applications, McGraw- Hill, 6th Edition, 2006.

Suggested Reading:

1. Tocci, Widmer, Moss, Digital Systems, Principles and Applications, Pearson Education, 10th Edition, 2016.
2. B. Somnath Nair, Digital Electronics and Logic Design, Prentice Hall of India, Eastern Economy, Edition, 2006.

16EE C11

LINEAR INTEGRATED CIRCUITS

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

Course Objectives:

1. To study the 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 mono-stable and an astable multi vibrator.
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 Amplifier 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

Waveform 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, , New Age Intern.(P) Ltd., 3^{rd} Edition 2007.
2. Malvino Albert Paul, Electronic Principles, , Tata McGraw Hill, 7^{th} Edition, 2006.

Suggested Reading:

1. Gayakwad R.A. Op-Amps and Linear Integrated Circuits, PHI, 4^{th} Edition, 2002.
2. David A. Bell, Operational Amplifiers and Linear ICs, PHI, 2003.
3. Coughlin and Driscoll, Operational Amplifiers and Linear integrated Circuits, PHI, 6^{th} Edition, 2003.

16EE C12

ELECTRICAL MACHINES - I LAB

Instruction	1T+2P 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 performance & Load characteristics of different types of DC generators & DC motors.
2. To understand the procedure to separate core losses in a single phase transformer, perform Open Circuit and Short Circuit tests on single phase 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 DC 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.
6. Acquire knowledge to evaluate the performance aspects of DC generator, DC motor and Transformer.

LIST OF EXPERIMENTS

1. Magnetization characteristics and the speed verses voltage curve of separately excited DC generator and self excited D.C. generator
2. Load characteristics of separately excited DC generator and DC shunt generator.
3. Load characteristics of DC Compound generator.

4. Performance characteristics of DC series motor.
5. Swinburne's test & determination of 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.
14. Load test on single phase transformers.

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

16EE C13

LINEAR INTEGRATED CIRCUITS LAB

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

Course Objectives:

1. To analyze and design various applications of Op-Amp.
2. To design and construct waveform generation circuits.
3. To design and implement timer and analog and digital circuits using op amps.
4. To design and implement combinational logic circuits using digital IC's.
5. To design and implement Active Filters, such as Low pass, High Pass, Band Pass for various cut off frequencies.

Course Outcomes: After completing the Lab course, 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.
6. Acquire knowledge concerning the application aspects of synchronous as Asynchronous counters, A/D and D/A converters.

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.

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, Free Press, 1989, New York.

Core Courses offered to other Departments

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	
PRACTICALS								
1	16EE C05	Basics of Mechanical and Electrical Engineering Lab Part-B (for B.Tech Chemical III-SEM)	0/1	2	3	25	50	2
		Total	**1**	**2**	**-**	**25**	**50**	**2**

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

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 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%.

16EEC05

BASICS OF MECHANICAL AND ELECTRICAL ENGINEERING LAB
(B.Tech. Chemical III - SEM)

ELECTRICAL ENGINEERING LAB
(PART-B)

Instruction	1T+2P 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 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.

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.

Core Courses offered to other Departments

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	
PRACTICALS								
1	16EE C14	Electrical Machines and Microcontroller Applications (for BE Mech. & Prod. IV-SEM)	4	-	3	30	70	4
		Total	**4**	**-**	**-**	**30**	**70**	**4**

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

CIE - Continuous Internal Evaluation SEE - Semester End Examination

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 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%.

16EE C14

ELECTRICAL MACHINES AND MICRO CONTROLLER APPLICATIONS
(Common to BE Mech & Prod IV-SEM)

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 understand the concepts of transformers.
2. To comprehend the need of DC & AC machines and their control aspects.
3. To know the features of 3-phase induction motors.
4. To understand the concepts of 8051 of microcontrollers.
5. To understand the basics of interfacing with 8051.

Course Outcomes: The student will be able to
1. Identify the compatibility of DC machines for a given application.
2. Identify the applications of 3-phase induction motor.
3. Calculate the Efficiency and regulation of transformer.
4. Program using 8051micro-controller.
5. Use 8051 for basic applications.
6. Acquire knowledge in analyzing the performance aspects of stepper motor, DC motor through interfacing with 8051 micro-controller.

UNIT- I

D.C. Generators: Constructional details, Principle of operation, EMF equation, Classification of generators, Armature reaction, Characteristics of shunt, series and compound generators.

DC Motors: Working Principle, back EMF, Classification of motors, Torque developed in motors, Characteristics of shunt, series and compound motors, Three point starter, Speed control of DC motors.

UNIT- II

Transformers: Construction, Working principle, EMF equation, Ideal transformer, Practical transformer on no load and load conditions, Equivalent circuit of transformer, Efficiency and regulation of transformer, OC and SC tests.

UNIT-III

Three Phase Induction Motors: Production of rotating magnetic field, construction and principle of operation, Torque Calculation, speed-torque characteristics, Speed control of 3-phase induction motors.

UNIT-IV

8051 Microcontrollers: Introduction to microprocessor, microcontroller classification, Internal architecture of 8051 and its pin configuration, Memory organization and expansion. SFR's: Counter and timers, serial data I/O, Interrupts.

8051 Instruction set: Addressing modes and Instruction set. Assembly Language Programming with 8051.

UNIT-V

8051 Interfacing: Expansion of I/O ports, A/D converter, D/A converter, Stepper motor interfacing with 8051, DC motor interfacing with 8051.

Text Books:

1. Kothari, Nagrath, Basic Electrical Engineering, Tata McGraw Hill Publications, 2nd Edition, 2007.
2. Md. Ali Mazidi, J.Gilispie Mazidi & R.D. MCkinlay, The 8051 Microcontroller &Embedded Systems using Assembly and C, 2nd Edition, Pearson Education, 2007.

Suggested Reading:

1. B. L.Theraja & A.K. Theraja, A Text book of Electrical Technology, S.Chand & Co, 24th Edition,2007.
2. P. V. Prasad, S. Sivanagaraju, Electrical Engineering: Concepts and Applications, Cengage Learning, 1st Edition, 2012.
3. V.K.Mehta, Principles of Electrical Engineering, S.Chand & Co, 1st Edition, 2003.
4. Ayala K.J, The 8051 Micro Controller Architecture, Programming and Application, West Publishing Company, 2007.

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', 9th Edition, Tata McGraw Hill, 1983.
2. M.A.Pai, 'Computer techniques in Power System Analysis', 3rd Edition, Tata McGraw Hill, 2014.

Suggested Reading:

1. L.P. Singh, 'Advanced Power System Analysis and Dynamics', 6th Edition, New Age International Publishers, 2014
2. Kusic Gearge L, 'Computer Aided Power System Analysis', 2nd Edition, CRC Press, 2008.

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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, 2^{nd} Edition Springer International Edition, 1992
2. Roy Billinton and Ronald N. Aallan "Reliability Evaluation of Power Systems", 2^{nd} 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.

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 or improve the quality of work and report it

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Scheme and Syllabi of

M.E. (EEE)

Power Systems and Power Electronics

2016 - 2017

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(Autonomous) (Affiliated to Osmania University)

Gandipet, Hyderabad-500075

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(AUTONOMOUS)
Gandipet, Hyderabad – 500 075

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION AND MISSION OF THE INSTITUTE

Vision:

- To be a centre of excellence in technical education and research.

Mission:

- To address the emerging needs through quality technical education and advanced research.

VISION AND MISSION OF THE DEPARTMENT

Vision:

- To be in forefront in assimilating cutting edge technologies in the field of Power & Electronics arena.

Mission:

- Imparting need based Engineering Education
- Extending the consultancy through Centre of Excellence with the support of public and private sector organizations
- Exposure to practical problems through Industry Institute interaction
- Solutions to practical problems through incubation center
- Complementing the engineering training through extra and co-curricular activities
- Taking technologies blended with ethics and morals to the society for sustainable growth to cater to the needs of the society.

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Programme Educational Objectives (PEO)

Post graduates of the PS&PE programme

PEO1: Will excel in power system and power electronics area.

PEO2: Will become successful in executing software related applications.

PEO3: Will carry out research in new and applied technologies relevant to PS & PE.

PEO4: Will develop with professional ethics, effective communication skills, and knowledge of societal impacts of computing technologies.

Programme Outcomes (PO)

POs describe what students are expected to know or be able to do by the time of Post Graduation from the program.

Post graduate students of PS&PE program will acquire ability to

PO1: Apply knowledge of core subject which is derived ab initio in their four year UG program.

PO2: Stimulate an idea which is thought provoking in formulating engineering requirement.

PO3: Form a problem, analyze, diagnose and arrive for many solutions.

PO4: Design (which is blended with simulation) prototype model which is a primitive.

PO5: Use digital techniques, program skills & modern simulation tools necessary for soft computing methods.

PO6: Fulfill the aphorism "Think locally act Globally" in order to cater to the needs of society such as Cultural and Environmental issues.

PO7: Maintain the knowledge levels on par with contemporary competencies.

PO8: Comprehend the professional, ethical, legal, security and social responsibilities.

PO9: aware that education is possession that cannot be isolated from the individual throughout their life.

PO10: Communicate cogently with people from all walks of life.

PO11: Demonstrate the capability and knowledge to modify the problem formulation and methods of solution based on the results to arrive at acceptable outcome, independently.

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Scheme of Instruction & Examination

M.E. (Power Systems & Power Electronics) Four-Semester Course (Full-Time) 2016-17

S. No	Subject	Periods Per Week		Semester Exam Duration(Hrs.)	Max. Marks		Credits
		L	T/P		Internal Assessment	End Exam	
SEMESTER-I							
1	Core 1	3	1	3	30	70	4
2	Core 2	3	1	3	30	70	4
3	Core 3	3	1	3	30	70	4
4	Elective 1	3	-	3	30	70	3
5	Elective 2	3	-	3	30	70	3
6	Elective 3	3	-	3	30	70	3
7	Lab-1	-	3	-	50	-	2
8	Seminar-I	-	3	-	50	-	2
9	Soft Skills	--	2	--	* Non-Credit		
	Total	**18**	**11**		**280**	**420**	**25**
*Internal Assessment only and awarded with "Satisfactory/Not Satisfactory							
SEMESTER-II							
1	Core 4	3	1	3	30	70	4
2	Core 5	3	1	3	30	70	4
3	Core 6	3	1	3	30	70	4
4	Elective 4	3	-	3	30	70	3
5	Elective 5	3	-	3	30	70	3
6	Elective 6	3	-	3	30	70	3
7	Lab-2	-	3	-	50	-	2
8	Seminar-II	-	3	-	50	-	2
9	Mini Project	-	2		50	-	1
	Total	**18**	**11**		**330**	**420**	**26**
SEMESTER-III							
1	Project Seminar (i) Problem formulation & submission of synopsis within 8 weeks from the commencement of 3rd sem. (50 Marks) (ii). Preliminary work on Project implementation (50 Marks)				100	-	**6**
	Total				**100**	**-**	**6**
SEMESTER-IV							
1	Project Work & Dissertation				100	100	**12**
	Total				**100**	**100**	**12**

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M.E (Power Systems and Power Electronics)

List of Theory and Practical Subjects

Sl.No	Code No	Core Subjects
1	16EEC101	Power Semi-Conductor Devices and Circuits
2	16EEC102	Distribution System Planning and Automation
3	16EEC103	Advanced Computer Methods in Power Systems
4	16EEC104	Power System Stability
5	16EEC105	Advanced Electric Drives
6	16EEC106	Flexible AC Transmission Systems
		Practicals
7	16EEC107	Power Systems Lab
8	16EEC108	Power Electronics Lab
9	16 EG 104	Soft Skills Lab
10	16EEC109	Seminar-I
11	16EEC110	Seminar- II
12	16EEC111	Mini Project
13	16EEC112	Project Seminar
14	16EEC113	Project Work & Dissertation
		Elective Subjects
15	16EEE101	Machine Modeling and Analysis
16	16EEE102	Modern Control Theory
17	16EEE103	Advanced Power System Protection
18	16EEE104	Real Time Applications in Power Systems
19	16EEE105	Deregulation of Power Systems
20	16EEE106	Soft Computing Techniques to Power Systems
21	16EEE107	Renewable Energy Sources
22	16EEE108	Reliability Modeling in Power Systems
23	16EEE109	Power Quality Engineering
24	16EEE110	Energy Management
25	16EEE111	Advanced Microprocessor Systems
26	16EEE112	Digital Control Systems
27	16EEE113	HVDC Transmission
28	16EEE114	Research Methodology & Professional Ethics

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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.

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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.

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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

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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.

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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-measurement**s, S**tatistical 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.

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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", 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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